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Demonstration and Evaluation of Technologies for Determining the Suitability of USTs for Upgrading with Cathodic Protection

by

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E. Timothy Oppelt, Director
National Risk Management Research Laboratory

Abstract

Field applications of three alternate technologies for assessing the suitability of underground storage tanks for upgrading by the addition of cathodic protection were observed and documented. The technologies were applied to five existing underground storage tanks that were slated for removal. Noninvasive statistical modeling, invasive inspection by remote video camera, and invasive internal inspection were applied to each of the tanks. Three vendors applied their individual statistical modeling approaches to assess the suitability of the tanks for upgrading with cathodic protection. One vendor demonstrated remote video camera inspection technology, and another conducted an internal inspection by entering the tanks. After all of the technology assessments were conducted, the tanks were removed and inspected both externally and internally by non-destructive and destructive means to determine their actual condition. The determinations made using the alternate technologies were then compared to the actual condition of the tanks.

Each of the alternate assessment technologies concluded that the tanks (or sites) were not suitable for upgrading with cathodic protection. The inspections and tests conducted after excavation of the tanks arrived at the same determination. Perforations from corrosion were documented in four of the five tanks, and deep pitting by corrosion was found in the remaining tank. The results of this comparison are strictly qualitative due to the small number of tanks included. The results of this limited study cannot be extrapolated to make conclusions beyond those made for the specific tanks tested.

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Section 1
Introduction

1.1 Background

Federal Regulations regulating underground storage tanks (USTs) (40 *CFR* 280 and 28 1) require that all UST systems must be replaced, upgraded, or closed by December 22, 1998. Owners and operators choosing to upgrade their UST systems via cathodic protection, internal lining, or cathodic protection combined with an internal lining must determine the integrity of their system prior to upgrading to ensure that it is suitable for upgrading.

To be suitable for upgrading by cathodic protection alone (that is, without also lining the tank), in accordance with 40 *CFR* Part 280, "Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks," the integrity of the tank must be ensured [Section 280.21(b)(2)]. For tanks that are 10 years old and older, two methods for ensuring the integrity of a tank prior to upgrading with cathodic protection are stated in the EPA regulations (*CFR* 280.21(b)(2)). They are:

> "(i) The tank is internally inspected and assessed to ensure that the tank is structurally sound and free of corrosion holes prior to installing the cathodic protection system;"

> "(iv) The tank is assessed for corrosion holes by a method that is determined by the implementing agency to prevent releases in a manner that is no less protective of human health and the environment than subparagraphs (i) through (iii)."

Subparagraphs (ii) and (iii) of *CFR* 280.21(b)(2) refer to tanks less than 10 years old. Because Federal Regulation has required since 1985 that new regulated USTs be protected against corrosion, there are few USTs that can use subparagraphs (ii) and (iii) to comply.

Determining the integrity of UST systems and their suitability for upgrading usually requires some type of internal inspection or assessment. Past practices typically involved tank entry and manual inspection of the interior which necessitated significant down time from normal operations. In 1994, the American Society for Testing and Materials (ASTM) Committee E50 on Environmental Assessment and Subcommittee E50.01 on Storage Tanks issued an Emergency Standard Practice, ES 40-94, "Emergency Standard Practice for Alternative Procedures for the Assessment of Buried Steel Tanks Prior to the Addition of Cathodic Protection." This standard, which expired in November of 1996, provided recommended minimum performance practices for three alternative methods for assessing the suitability of USTs for upgrading by adding cathodic protection. These methods are tank life/corrosion rate modeling, remote video camera testing, and robotic ultrasonic testing.

In accordance with ES 40-94, application of each of these alternate assessment methods includes acquisition and consideration of site information including tank age, existence of stray d-c current, presence of other buried metal structures, material of construction and electrical isolation, and tank leak and repair history. In particular, the UST must also pass a suitable leak detection test. These methods all include consideration of basic site-specific tests of the tank environment including:

- Stray current/corrosion/interference
- Soil resistivity
- Structure to soil potential
- Soil pH
- Electrical continuity/isolation

In addition, other tests may be conducted by a corrosion expert including measurements of hydrocarbon, chloride, sulfide, and sulfate ion concentrations in soil and resistance of the tank coating. Some state regulatory authorities have approved the use of these methods; however, others are withholding approval, pending an evaluation of their performance.

The objective of this project was to observe and document the performance of the three alternative methods described in ES 40-94, as well as the existing method of manual internal inspection, in determining the condition of several USTs. Vendors of each method were invited to apply their technology to a set of USTs and report their assessment of whether the tanks were suitable for upgrading with cathodic protection. During the project, three different methods of tank life/corrosion rate modeling, one method of remote internal video inspection, and one company's procedure for the existing method of internal inspection were observed. Participating vendors provided copies of their protocols prior to conducting the assessments. These protocols are not reproduced herein but have been provided to the EPA Work Assignment Manager. As discussed in the report titled "State-of-the-Art Procedures and Equipment for Internal Inspection and Upgrading of Underground Storage Tanks," November 1996, the robotic ultrasonic inspection method technology is not yet commercialized, like the modeling and internal video methods. The vendor of this technology declined to participate in the current evaluation.

After each of the five test tanks were evaluated, the tanks were removed and the actual condition of the tanks was determined by a series of baseline tests, some of which were destructive. The baseline tests were limited to the USTs themselves and did not include an assessment of other site variables such as soil data.

The performance of each assessment method was observed and documented by comparing the vendor's conclusion as to whether each tank was suitable for upgrading with cathodic protection to the condition of the tank as determined by the baseline testing. The results of this comparison are qualitative due to the limited number of tanks included in the evaluation. The small sample size (limited by funding resources) precluded acquisition of data that could be subjected to statistical interpretations and extrapolations.

1.2 Assessment Methods Observed and Documented

1.2.1 Noninvasive Tank Life/Corrosion Model Tests (i.e., modeling)

This method of assessment examines the soil environment in the immediate vicinity of the UST and the relationship of the metal UST to this environment. A statistical model is used to assess the relationship between the aggressiveness of the environment and the rate of corrosion and to predict the remaining life of the UST prior to corrosion failure. The site-survey and site-specific tests noted above are therefore conducted in more detail during application of this technology than for the others. For example, the stray current measurements typically use a microprocessor-controlled data acquisition unit which takes data samples at 5-second intervals. The soils data usually are based on samples collected at 2-A intervals from two or more holes bored at least as deep as the bottom of each of the tanks.

The model input data include the results of the soil analysis as well as the various electrical measurements (e.g., structure-to-soil potential). The statistical model used to interpret the data is required to have been developed on at least 100 sites with at least 200 tanks that were subsequently excavated and inspected by a corrosion expert. The model must also include factors such as the presence of a water table, annual precipitation and average temperature.

The output of the model includes an estimated leak-free life of the tank (which must have a standard deviation of not more than 1.5 years) and an estimated probability of corrosion perforation. Tanks with an age less than the estimated leak-free life and with a probability of corrosion perforation less than 0.05 (5 percent) may be upgraded by the addition of cathodic protection using an appropriately designed cathodic protection system. This method is described in detail in ASTM ES 40-94.

1.2.2 Invasive Remote Video Camera Tests

Application of this method of assessment also includes acquisition of the basic site survey information and site-specific measurements described in Section 1.1. Invasive video technology involves insertion of a remotely operated video camera and suitable lighting source into the tank. Prior to testing, the tank is prepared according to specifications documented in their written procedure. The video system must be capable of recording a video survey of the interior surface of the tank. The detailed requirements of the video system are included in ASTM ES 40-94.

The video system is initially used to confirm that the tank is sufficiently clean for effective video inspection. The camera is then controlled to systematically record a visual inspection of the internal tank surfaces. A recorded voice override (i.e., narration) and text input are recorded on the video tape to document the direction and location of the view and the comment on observations and findings. The vendor documents any evidence of corrosion including:

- Perforations
- Rust tuberculation
- Streaks
- Discoloration
- Pitting
- Scaling or de-laminations
- Weld corrosion
- Cracks
- Passive films

Based on this visual examination, review of the site-specific environmental data, and consideration of tank age, the corrosion expert determines whether corrosion or deterioration is evident that would make the tank unsuitable for upgrading with cathodic protection. The corrosion expert also determines whether the tank requires further inspection by other procedures, or whether the tank is suitable for upgrading with cathodic protection.

1.2.3 Invasive Internal Inspection

Determination of the structural integrity of USTs has most commonly been accomplished by means of human inspectors entering properly prepared tanks and applying various inspection techniques. Current practice is to perform a visual inspection either alone or in combination with other measurements. The techniques used during the internal inspection included: (a) visual inspection for holes, cracks, and deformation, (b) “hammer test” involving striking the inside of the tank with a ball peen hammer to identify structurally weak areas and/or judging the relative thickness of the area by the resonant sound produced; (c) magnetic flux scanning of the interior surface for flaw detection; (d) ultrasonic flaw detection scanning; and (e) ultrasonic transducer measurement of the wall thickness on a grid pattern.

Typically the top of the UST must be exposed by excavation and an opening (minimum 18 in by 18 in) cut in the top of the tank if a access way does not exist. The UST must be ventilated to provide a breathable atmosphere and to eliminate any tire/explosion hazards. Persons entering the tank must wear protective clothing and be equipped with a supplied air system. Sludge must be removed from the tank and the tank cleaned and abrasively blasted prior to performing the internal inspection. The vendor must follow all applicable OSHA and other regulatory requirements governing health and safety. Generally the internal inspections follow the guidelines in American Petroleum Institute (API) 163 1, “Interior Lining of Underground Storage Tanks, 3rd Edition, April

1992," or National Leak Prevention Association (NLPA) 63 1 "Entry, Cleaning, Interior Inspection, Repair and Lining of Underground Storage Tanks."

1.3 Baseline Tests

The UST assessment methods discussed above are performed with the tank in place and consequently are limited to assessments of the soil and the interior of the tank. However, corrosion and pitting may occur on the outside of the tank as well as on the inside. Therefore, the baseline tests which were conducted after the USTs were removed from the ground included examination of both the interior and exterior surfaces to establish the actual condition of the tank. Baseline testing was concluded upon identification of a disqualifying flaw. If no disqualifying flaw was found, the inspection was completed.

The internal and external baseline method is similar to the standard visual inspection method, with several additions. The exterior of the tank was visually inspected immediately after excavation. The purpose of this inspection was to detect surface discontinuities such as cracks, holes, and pits, and to describe the amount and type of any corrosion observed. If no obvious disqualifying flaws (such as corrosion perforations) were observed, a grid pattern using 3 ft by 3 A grids was marked on the inside and outside of the tank, and both the interior and exterior (before and after abrasive blasting) were visually inspected. (Access ways were cut into both the top and one end of each tank for ingress and egress.) Photographs were used to document the condition of the tank. The depths of the deepest pits were measured.

For tanks that were not disqualified due to the presence of an obvious perforation or other flaw, ultrasonic measurements were then conducted to determine wall thickness. This testing was done primarily from the interior of the tank, but could also be done from the outside. Ultrasonic measurements were made at the approximate center of each marked grid. Wall thicknesses were also measured by drilling a sentry hole and using a through-wall micrometer. The minimum required initial wall thickness for each tank was determined by the tank size in accordance with Underwriters Laboratory (UL) 58 "Standard for Steel Underground Tanks for Flammable and Combustible Liquids."

The results of the baseline tests were evaluated in accordance with the criteria specified in Section 2.2.3 of the Quality Assurance Project Plan to classify the tank as being either suitable or unsuitable for upgrading with cathodic protection. The three acceptance criteria specified in the QAPP are summarized below.

To be considered upgradable by cathodic protection, the tank must:

1. Be free of corrosion holes. Any perforation found during the baseline tests will disqualify that tank.

2. (a) Have no pits deeper than 0.5 times the required minimum wall thickness and (b) an average wall thickness in each 3 ft by 3 ft area of at least 85 percent of the required minimum wall thickness. A tank is unsuitable if either (a) or (b) is not

met. The required minimum wall thickness varies with the size of the tank but is generally 0.240 inch. Requirement (a) implies that there can be no perforations.

3. Be free of corrosion holes and cracks or separations in the tank welds (or elsewhere) as determined by visual observation after abrasive blasting.

If a tank fails any of these criteria, it is not suitable for upgrading.

1.4 Project Objectives

The primary objective of the project was to observe and document the performance of commercially available techniques/methodologies for evaluating and predicting the integrity of steel UST systems and their associated amenability to upgrading with cathodic protection.

1.5 Experimental Design

Five steel USTs located at a site near Gardner, Kansas, and as described in detail in Section 2 of this report, were used in the study. The number of USTs included in the evaluation was limited to five due to funding restrictions. This small number of tanks does not constitute a statistically valid population for assessing the performance of the various technologies. The results presented in this report, therefore, are qualitative in nature.

Each of the five tanks was assessed by each participating vendor. The vendors supplied reports in their standard format including their conclusions as to the suitability of each UST for upgrading. Vendors first presented their conclusions in the absence of knowledge of the results of tank tightness tests which had been performed on the tanks. Subsequently, the results of the tank tightness tests were provided to the vendors and they were given the opportunity to revise their reports based on these additional data.

Section 2
Study Site

This study was conducted at the New Century Air Center, the former Olathe Naval Air Station, which is situated in New Century, Kansas, just north of Gardner. The U.S. Army Corps of Engineers was conducting a removal action involving a number of tanks at this site. The specific tank gallery included in the study contained eight tanks which were arranged in two rows of four tanks each, separated by a concrete vault that contained piping and valves. At the initiation of the project, two of the eight tanks were found to be filled with water. Because this would not be typical, these USTs were excluded from the study. A schematic of the site is provided in Figure 1.

The history of the tanks was documented through discussions with facility personnel, the Corps of Engineers, and their contractor. It was determined that the tanks were installed in 1943 or 1944. They had been used to store fuel for a small on-site power plant built in 1943. The tanks were registered as having been installed in 1944. The tanks were not cathodically protected. They were taken out of service 6 to 10 years ago, sometime in the period of 1986 to 1990. At that time, the tanks contained No. 2 fuel oil or No. 2 diesel. Apparently the product was pumped out and the tanks left in place empty. Each of the six tanks included in the study contained approximately 200 gallons of residual product with some water phase in some of the tanks. The results of stick readings (presumably taken in August, 1995) were provided on the site drawing of that date. MRI confirmed the measurements on the site drawings by sticking the tanks in July, 1996.

The tanks were used to fuel the boilers and diesel generators at a small power plant (Building 14). There were no submersible pumps or turbines present in the tanks. Fuel was dispensed via a suction system, probably with a return line to each tank. The concrete vault between the two rows of tanks was reported to contain piping and valves relating to the fuel system.

A past employee contacted during the study indicated that early in the life of the tanks, they may have contained heavier product, e.g., No. 4 fuel for use in the power plant, however, more recently the product was No. 2. The tanks were found to be equipped with steam heating coils along the bottom of each tank, implying that they were used or intended to be used for heavy product such as No. 4 or No. 6 heating fuel.

No historical information regarding cleaning of the tanks was found. At the initiation of this project, they were cleaned by pumping out any residual sludges and liquids and then pressure washed with a biosolvent. The study tanks included two tanks (Nos. 24 and 25) located on the south side of the vault and three tanks (Nos. 18, 19, and 20) which were situated on the north side of the vault.

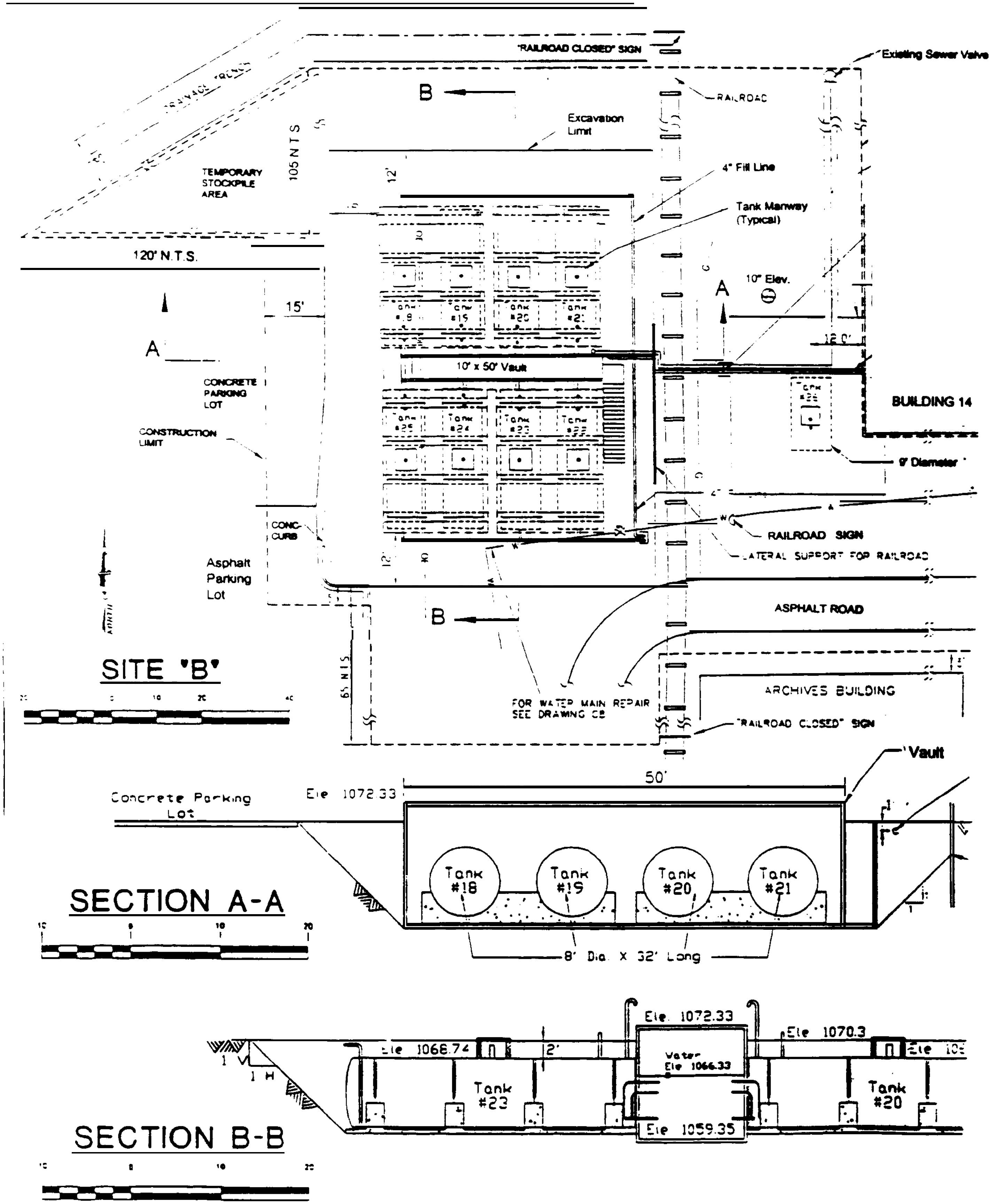


Figure 1. Diagram of the Tank Site

The initial information obtained indicated that the tanks were constructed of bare steel. Each tank had a circular access way 18 inches in diameter which was surrounded by a concrete vault about 4 feet square. The portion of the tops of the tanks that was visible around the access ways appeared to be bare steel. However, when the tanks were subsequently excavated, it was found that they had been coated with brushed-on coal tar and wrapped with kraft paper. This coating and wrap had slumped approximately one-third of the way down from the top of the tank and was not visible prior to excavation.

Section 3
Tank Tightness Test Results

The ASTM ES 40-94 standard requires that a tank tightness test be conducted in conjunction with any of the alternative methods. The UST under-till test method was chosen for this study because the tanks were expected to have significant piping and connections that might pose problems with an overfill test method, i.e., the overfill test method would also test the piping, which was not included in the scope of this study.

The tanks were tested using the water that had been stored in Tank Nos. 22 and 23. The water was pumped into each of the five test tanks in turn. The testing was conducted with the tanks slightly more than 95% full. The test level ranged from 87 inches of water to 90.5 inches of water.

A summary of the tank tightness test results is presented in Table 1. The complete report supplied by the tank tightness testing vendor is included in Appendix A.

Table 1. Summarv of Tank Tightness Test Results

Tank number	Leak rate (gal/hr)	Conclusion
18	0.665	Not Tight
19	0.016	Tank is Tight
20	0.344	Not Tight
24	0.074	Not Tight
25	0.103	Not Tiaht

During the tightness testing it had been assumed that any piping connections to the tanks entered through the top of the tank, which is usually the case. However, upon excavation, it was discovered that some piping connections entered through the end cap of each tank. One end cap of each tank was found to have connections with two 1.5-inch pipes for the steam loop near the bottom of the tank. In addition, each tank had a 3 inch suction pipe that entered in the center of the end cap and extended to near the bottom of the tank. Any leaks in this piping would affect the tank tightness test results. Additionally, these pipes might have had the effect of making all the tanks electrically connected through the piping. The four tanks on each side of the vault also had a common 4-inch fill pipe that entered through the top of the tank at the end away from the concrete vault, which might have constituted an electrical connection between the four tanks on each side of the vault.

The tank tightness test results presented in Table 1 are not entirely consistent with the findings of the subsequent baseline tests. For example, Tank No. 19 tested tight, although it was later found to have several perforations. A possible explanation is that the tanks were installed in very tight, moist, and highly plastic clay. This clay may have prevented any significant loss of water during the test, allowing the conclusion that Tank No. 19 was tight. Further, the holes in Tank No. 19 and the other tanks were tilled with corrosion product when the tightness testing was being done. It is likely that this corrosion product, together with the clay backfill, reduced the leak rates from what would be expected with holes after the corrosion product was removed.

In addition, Tank No. 25 was judged to be leaking at a slow rate (0.103 gal/hr), while upon examination in the baseline tests it was found to have no perforations. Upon examination, it was found that the 3-inch pipe in the center of the tank had been installed with a brass fitting. Such a fitting would be likely to contribute to preferential corrosion of the pipe just outside the tank, and, indeed, some corrosion holes were found in some of those pipes. Thus, the leak rate indicated for Tank No. 25 by the tightness test might have been due to leaks in the 3 inch pipe rather than in the tank body.

Section 4
Technology Test Results

Five vendors assessed the five test tanks at the study site. Three vendors used the modeling method of ASTM ES 40-94, one vendor used an internal video camera coupled with a site inspection also per ASTM ES 40-94, and one vendor conducted internal (human entry) inspections of the 5 tanks according to NLPA 63 1. The following subsections describe each vendor's testing and results. Each method was observed and compared to the applicable standard and to the vendor's standard operating procedure. Deviations from the standard, some of which were necessitated by the characteristics of the site, are noted in this report. Appendix B contains the vendor reports.

4.1 Modeling Method

4.1.1 International Lubrication and Fuel Consultants, Inc. (ILFC)

ILFC conducted its assessment of the site and tanks over a six-hour period on July 18, 1996, according to the corrosion modeling approach/procedures outlined in ASTM ES 40-94. A few adjustments had to be made based on site-specific conditions. About five fewer borings were taken than usual because the concrete vault and steps at the site prevented borings in these areas. ILFC took samples of product in two of the tanks as an addition to their usual procedure.

The detailed test results are presented in the ILFC report in Appendix B. Structure-to-soil potential measurements were made in each boring. A stray current test was done. Soil resistivity was measured by the Wenner 4-point method, with spacings of 5, 10, 15, and 20 feet, which is a slightly different spacing than suggested in ASTM ES 40-94. Soil samples were taken to a laboratory and analyzed for several parameters, including hydrocarbons.

ILFC concluded that on the basis of their field investigation and laboratory analyses, these tanks did not meet their TEP (Total Environmental Profile) criteria, nor did the tanks meet the ASTM ES 40-94 criteria for upgrading by the addition of cathodic protection. After receiving the results of the tank tightness tests, ILFC did not change their conclusion. They reported that the tanks were electrically continuous and therefore represented one unit, so the conclusion of not being upgradable applied to the site rather than to the individual tanks.

4.1.2 Corrpro Companies Incorporated/Warren Rogers Associates (WRKRP)

This method is based on a mean time to corrosion failure model. The field testing was conducted by Corrpro and the report provided by Warren Rogers Associates. Testing in the field was done over an 8-hour period on July 23, 1996. The testing would have been finished about 3:00, but the field crew encountered difficulty in finishing the last soil boring, hitting obstructions before they reached the depth of the bottom of the tank. Repositioning and drilling additional holes delayed the completion of the field work about 2 hours.

As with the model used by ILFC, this method considers the site as a unit rather than individual tanks; i.e., results and conclusions are reported on a site basis-not for individual tanks. Initially WR/CPR considered the test site as a single site, but later, decided that the separation by the concrete vault qualified it as two separate sites. Thus, WR/CRP provided a result for the north side of the vault (Tanks 18, 19, and 20) and a separate result for the south side of the vault (Tanks 24 and 25).

WRKRP followed the standard procedures required by ASTM ES 40-94. Only one location for the stray current test was required, because WR/CRP determined that the tanks were all electrically connected. The field crew requested access through the access ways as per their standard procedure, which is to assess the tank interior through all available openings. After consultation with EPA, they were required to use the fill pipe for access, since many tanks do not have access ways, i.e., representative conditions were maintained. WR/CRP also requested access to building 14 adjacent to the site for additional electrical tests. As MRI did not have access to that building, that access could not be provided.

The WRKRP report concluded that neither site was suitable for upgrading with cathodic protection. It stated that this result held regardless of the tank test results. The stated reason was a high probability of corrosion failure for both sites. The estimated mean time to corrosion failure was 11.8 years for the north site, compared to a tank age of 52 years. The estimated mean time to corrosion failure was 13 years for the south site, compared to an actual tank age of 52 years. A copy of the complete WRKRP report is presented in Appendix B.

4.1.3 Southern Cathodic Protection (SCP)

SCP conducted the field work at the site over about a six-hour period on August 14, 1996. Their method is based on a mean time to corrosion failure model and a probability of corrosion failure. They followed the procedures in the ASTM ES 40-94 standard and noted a few anomalies with the site. They noted an adjacent gas line that was cathodically protected with an impressed current system and requested access to the rectifier to turn the system off to test for possible effects on the tanks. As MRI did not have access to the rectifier box and was not able to obtain such access, that request could not be honored. SCP also noted that the field survey would normally be done only after receiving the results from the tank tightness test reports. SCP also noted, prior to the tests, that the model would not predict a mean time to corrosion failure that exceeded the age of the tank (52 years).

Based on their experience with the model they knew it would not accept the site for upgrading with cathodic protection. During field testing, a soil box was used for soil resistivity rather than the Wenner 4-pin method.

SCP estimated that the mean time to corrosion failure for these tanks ranged from 2 1.9 years to 23.4 years. Since the estimated time to failure is substantially less than the age of the tanks, SCP concluded that internal inspections are required in order to determine the suitability of the tanks for upgrading with cathodic protection. That is, each tank was determined to be unsuitable for upgrading with cathodic protection based on modeling, and an internal inspection was recommended. A copy of their report is presented in Appendix B.

4.2 Remote Video Camera Methods

4.2.1 Tanknology (TKNL) Internal Video

Tanknology assessed the five test tanks over a ten-hour period on July 29 and 30, 1996. They followed their standard operating protocol, which complies with the ASTM ES 40-94. Prior to inserting the camera, each tank was purged with CO, to inert the tank by reducing the tank's oxygen content to less than 5%. Several structure to soil potential readings were taken, but no soil borings were taken. They also sought access to the rectifier providing impressed current cathodic protection to the adjacent gas line in order to test for stray currents (with the rectifier turned off), but the access could not be provided.

Tanknology noted the presence of the steam pipes in the bottom of the tanks through their video. They also noted the existence of the 3-inch suction pipe that entered the tank at the middle of one end and then went into the vault. Although the tanks had been pressure washed with a biosolvent, Tanknology noted that the tanks were still dirty, with heavy buildup in the bottoms. This may indicate a limitation on the use of the video, in that if pressure washing the tanks from the outside does not provide a clean enough tank for the use of the video, its application may be limited. The fact that these tanks may have had heavy product in them for many years without cleaning may have resulted in the buildup of residue that limited the use of the video camera.

The conclusion of the visual inspection was that a light film has developed over the surface of the tanks. Heavy trash encapsulation was prominent throughout the tanks, which necessitated an additional investigation, since surface areas were covered and not visible for viewing. The ullage area was covered with excessive rust and tubercle formation, requiring further investigation following proper cleaning. The sludge remaining along the baffle plates and bracings for the heating coils also requires further investigation. The overall conclusion was that these tanks cannot be upgraded with cathodic protection until further investigation and suitable repairs are made. The video tape review indicated possible penetration of Tank No. 19, possible pinholes on the side of Tank 18, a small pinhole ingress on Tank No. 20, several suspect areas on Tank No. 25, and some suspect areas on Tank No. 24. All five tanks had some suspect areas, with three tanks having suspected perforations. A copy of the complete report is in Appendix B.

4.3 Internal Inspection Method

4.3.1 Armor Shield Internal Inspection

Armor Shield (AS) conducted internal inspections of the five subject tanks from July 3 1 through August 7 using NLPA 63 1 as a guide. AS used a variety of internal inspection techniques for this work. A visual inspection was performed on each tank. AS stated that in their opinion the state of the art for internal inspection was magnetic flux flaw detection following the visual inspection, with flaws indicated by the magnetic flux scan confirmed by ultrasonic inspection. This technique was new to the United States and differed from the standard method of an ultrasonic survey following visual inspection. After considerable discussion, AS agreed to perform a variety of internal inspection techniques, which are noted for each tank.

Each tank was first inerted, then entered by a technician equipped with personal protective equipment and supplied breathing air. Although the tanks were equipped with access ways, the diameters of the access ways were too small for safe entry; consequently, openings were cut to enlarge the access way for each tank. The steam heating pipes were removed from the tanks, pipe ends were capped, and sludge was removed from the tanks and drummed for disposal. Each tank was then abrasively blasted to remove any scale, rust, or corrosion product from the tank walls prior to inspection.

The internal inspection work took considerably longer than usual. Abrasive blasting of the tank's interiors had to be repeated after two days of heavy rain. The use of a variety of inspection techniques extended the test time further, particularly since additional supplies had to be shipped in.

AS identified areas with presumed external pits or flaws using magnetic flux screening. These areas were marked on the inside of the tank along with an ultrasonically measured wall thickness. During the subsequent baseline testing, these areas were investigated to determine whether an external flaw could be confirmed. The most extensive investigation was conducted on Tank No. 25, a total of 26 such suspect areas were identified. For 20 of these areas a deep external pit was identified. One area had a line of very shallow pits on the outside that might have been the cause of the detection. Five of the areas had no discernible external pit or flaw. Three areas were marked in Tank No. 18, and all corresponded to identifiable external pits. One area was marked in Tank No. 19 that corresponded to an external pit. The internal inspection also noted perforations in Tank No. 24, which probably contained corrosion product until the external abrasive blast removed it from the perforation.

The internal inspections resulted in the conclusion that none of the five tanks was suitable for upgrading with cathodic protection alone. Since each tank was evaluated using a different internal inspection technique, a summary of the results are presented below, by tank:

Tank 18 The visual inspection discovered perforations in the tank shell, which disqualified the tank for upgrading. Inspection was concluded at that point.

Tank 19 A partial magnetic flux scan was conducted. The tank was disqualified because of the discovery of perforations during the visual inspection.

Tank 20 A partial magnetic flux scan was conducted. The tank was disqualified because of the discovery of perforations during the visual inspection.

Tank 24 An ultrasonic flaw detector was used to scan the tank along its length at 1-foot intervals. The ultrasonic scan concluded that the tank was not suitable for upgrading with cathodic protection, due to pitting that exceeded 50% of the tank wall thickness. This tank was not disqualified as a result of the visual inspection.

Tank 25 A magnetic flux inspection was conducted after the visual inspection. On most of the tank, 100% of the tank surface was subjected to magnetic flux scanning, but for part of the tank, only 50% was covered. The goal was to see if the 50% scan could also detect external pitting. As a result of the magnetic flux inspection revealing pitting that exceeded 50% of the wall thickness, the tank was found to be unsuitable for upgrading with cathodic protection. The tank was also found to be unsuitable for upgrading from the visual inspection, which identified internal pits that measured more than 50% of the wall thickness.

Tank 25 was also subjected to a standard ultrasonic survey with point measurements taken at the approximate center of each 3-ft by 3-ft grid constructed on the interior surface of the tank. This tank was also found unsuitable for upgrading with cathodic protection as a result of the ultrasonic survey. AS reported that all ultrasonic readings in the first 3 feet of the north end of the tank indicated a wall thickness of less than 85% of the wall thickness (based on an assumed original wall thickness of 260 mills). The readings on the north end cap were also less than 85% of the assumed original thickness of 280 mills.

Section 5
Baseline Test Results

Upon completion of the vendor testing and assessment, the tanks were excavated. The tanks were removed from the excavation and placed on plastic sheets immediately north of the excavation. In general the tanks were lifted by placing an I-beam into the hole in the top of the tanks that had been cut during the internal inspection. The I-beam was then lifted by a track hoe. The tanks were moved to a field about a quarter mile away for further inspection (Figure 2). They were scraped and brushed to remove adhering soil. At that point it was discovered that the tanks had been coated with a brushed on coal tar and wrapped with Kraft paper. This wrapping and coating had slumped down along the sides of the tanks, leaving approximately the top third of the tank without any coating or with a minimal residue. In addition, the ends of the tanks that were closest to the vault were found to have a very wet coating, presumably from product interacting with the coating.

Upon removal, the exterior of each tank was visually inspected. Much of the tanks' surfaces could not be inspected effectively because of the coating and paper wrap. However, perforations were found in three of the tanks during this visual inspection. These perforations were approximately 3/8 inch in diameter, which rendered these tanks unsuitable for upgrading with cathodic protection, in accordance with the criteria specified in the QAPP.

The baseline tests were continued until a disqualifying flaw was found or until the specified tests were completed. If no disqualifying flaw was discovered the inspection was completed and detailed information about any pits, the wall thickness, and condition of the tank was documented. The findings of the baseline tests are presented tank by tank, indicating the point at which a disqualifying conclusion was reached. A summary of the baseline testing conducted on each tank is presented in the following paragraphs.

5.1 Tank No. 18

Immediately after removal, adhering clay soil was scraped from the sides of the tank. The tank was visually inspected and a perforation found about midway down the east side of the tank a few feet from its north end. A probe placed into the hole confirmed that it completely penetrated the wall (Figure 3). Selected areas around the perforation were abrasively blasted to bare metal and a number of obvious external pits were observed. Ultrasonic measurements were made on one end cap and a sidewall to obtain wall thickness data. These thickness measurements averaged 0.250 inch at section G-l and 0.279 at the end cap.

Figure 2   The Test Tanks During Testing

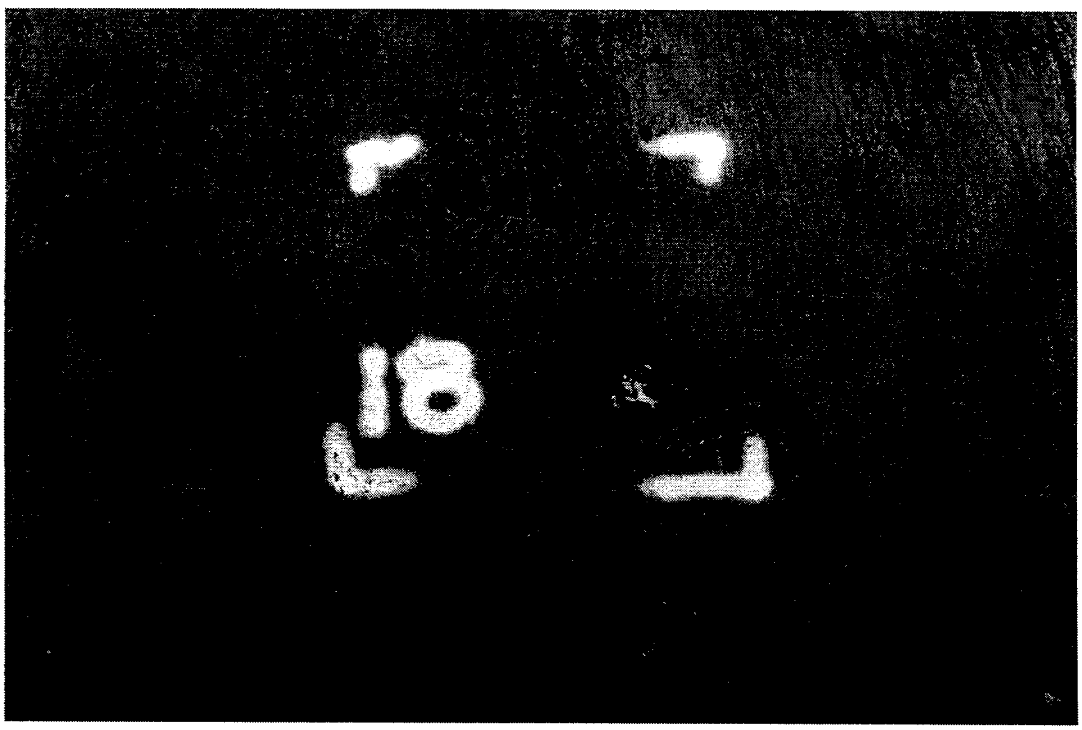


Figure 3   Perforation in Tank 18

5.2 Tank No. 19

Several large perforations were observed on the east side of the tank 6 to 9 feet from the north end and slightly above the midline (Figure 4). The area around the perforations was sandblasted and inspected. Wall thickness measurements indicated an average side wall thickness of 0.256 inch in section G-l and 0.267 on the end cap.

5.3 Tank No. 20

Tank No. 20 was removed from the ground on September 10, 1996. Visual inspection prior to abrasive blasting identified a perforation on the west side of the tank about 7 feet from the north end (Figure 5). The exterior surface near the perforation was abrasively blasted. Wall thickness measurement indicated a thickness of 0.257 inch in section G-l and 0.287 at the end cap.

5.4 Tank No. 24

Because of physical restrictions at the site, it was necessary to punch a hole with a tooth of the track hoe bucket in the north end cap to lift the tank. A large dent a few feet from the north end of the tank also resulted from the removal. Considerable overlapping pitting around the area of the access way was observed; however, no obvious perforations were found. Tank No. 24 was cleaned and an internal grid was applied in preparation for further baseline testing. The exterior of the tank was abrasively blasted. Following the abrasive blast, a small external pit was found which penetrated the tank shell. The perforation was about one-eighth of an inch in diameter (Figure 6). Ultrasonic measurement in section H- 1 indicated a wall thickness of 0.246 inch and 0.262 in the end cap.

5.5 Tank No. 25

Tank No. 25 was the first and most difficult tank to remove, due to the constricted working space and suction caused by wet clay. During removal a track hoe dented the tank along the west side and a hole was punched in the south end of the tank for lifting (Figure 7).

The post-removal visual inspection identified considerable overlapping pitting around the area of the access way. The tank was abrasive blasted and a grid was applied to the tank exterior. After the external inspection was completed, a grid was applied to the tank interior. Data from the external inspection are in Appendix C. The data from the external inspection, internal inspection, and ultrasonic wall thickness measurements are presented

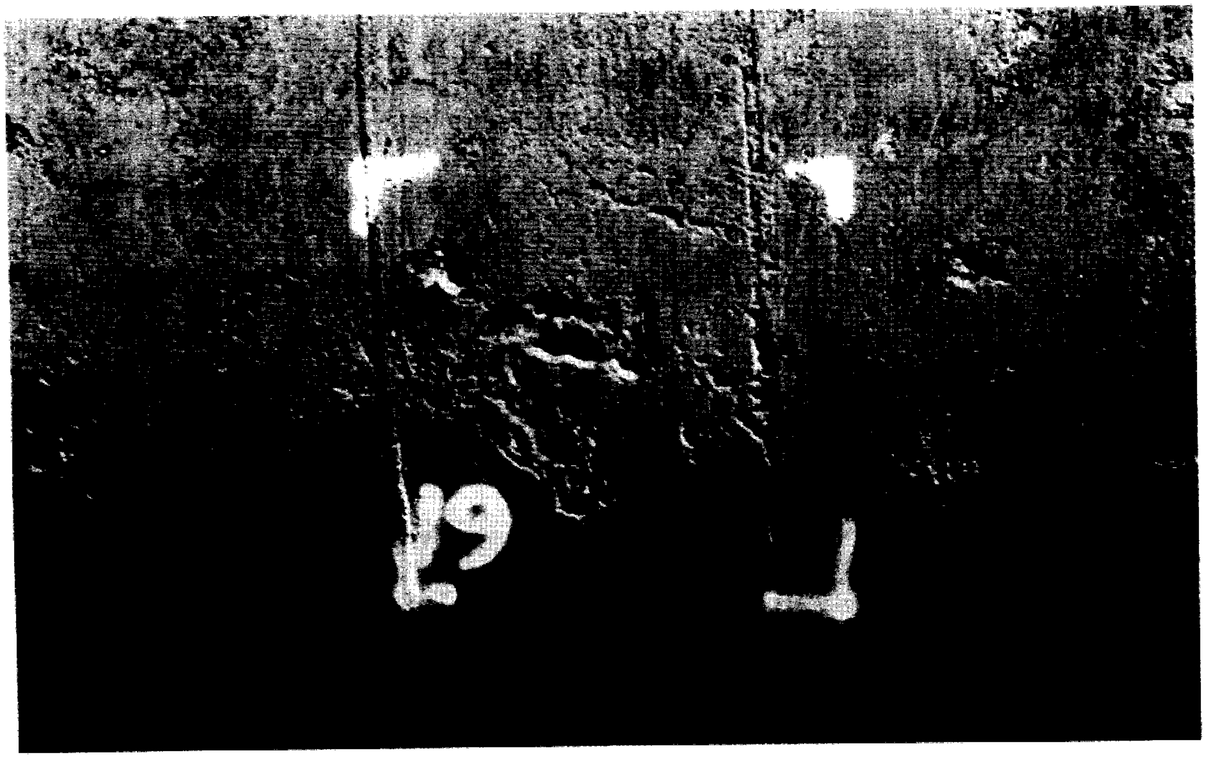


Figure 4 . Perforations in Tank 19

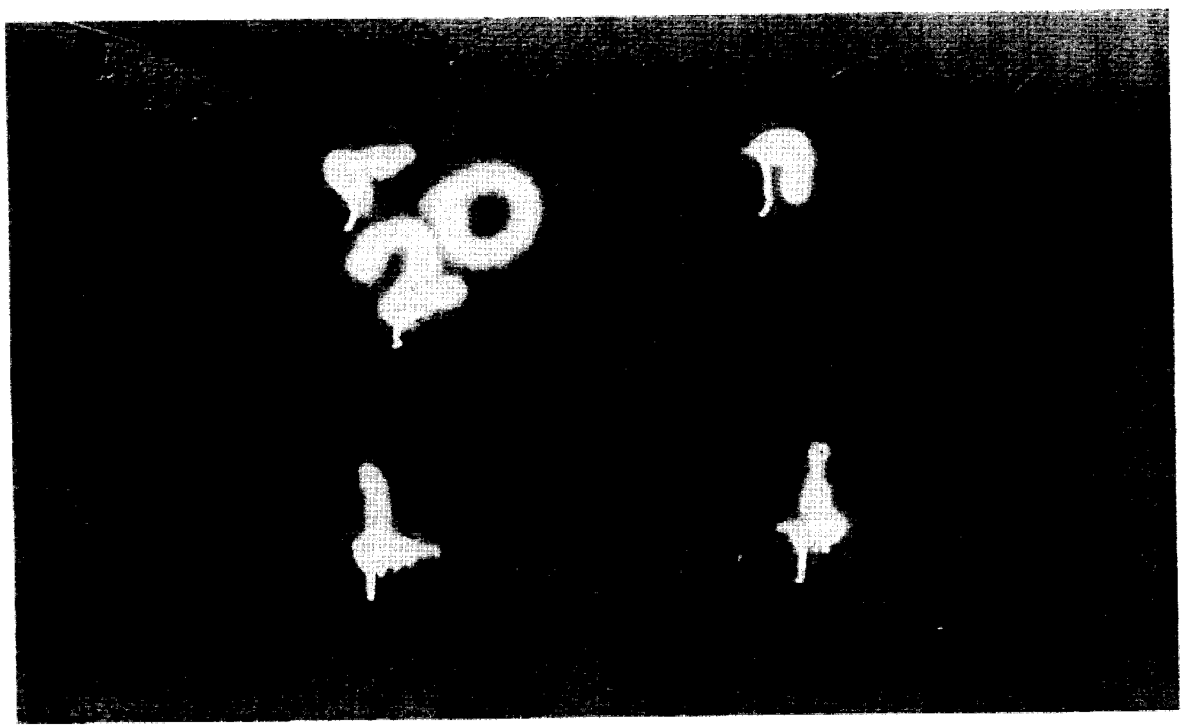


Figure 5 Perforation in Tank 20

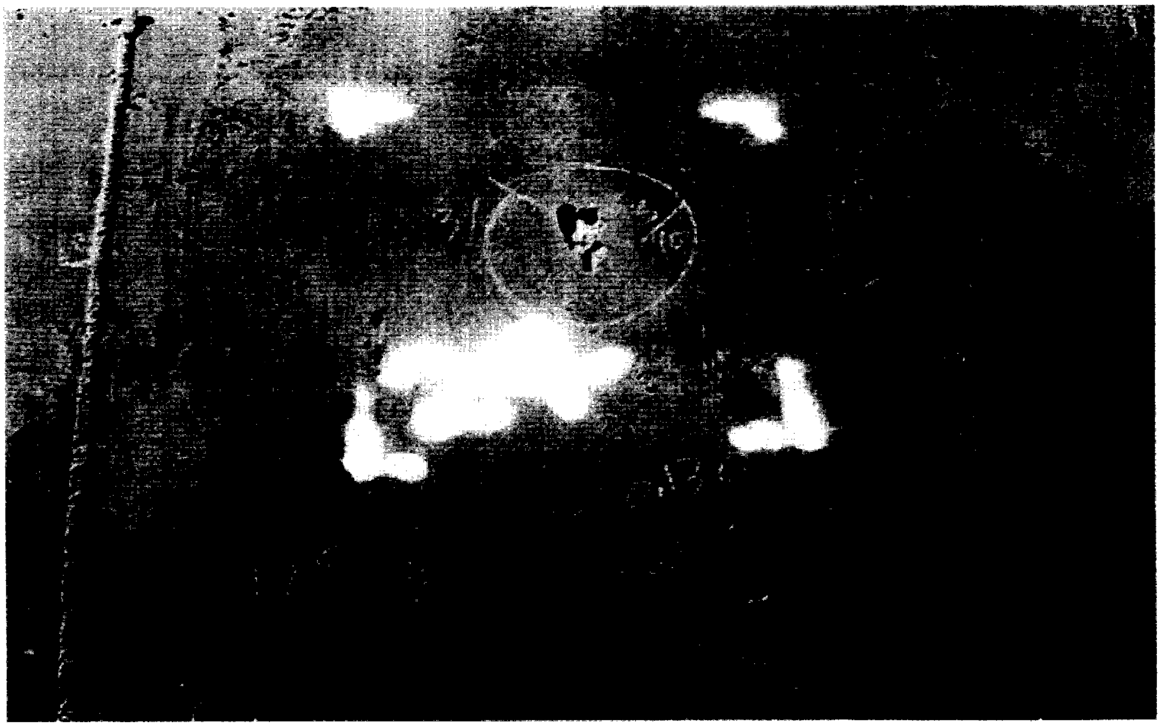


Figure 6 Perforation in Tank 23

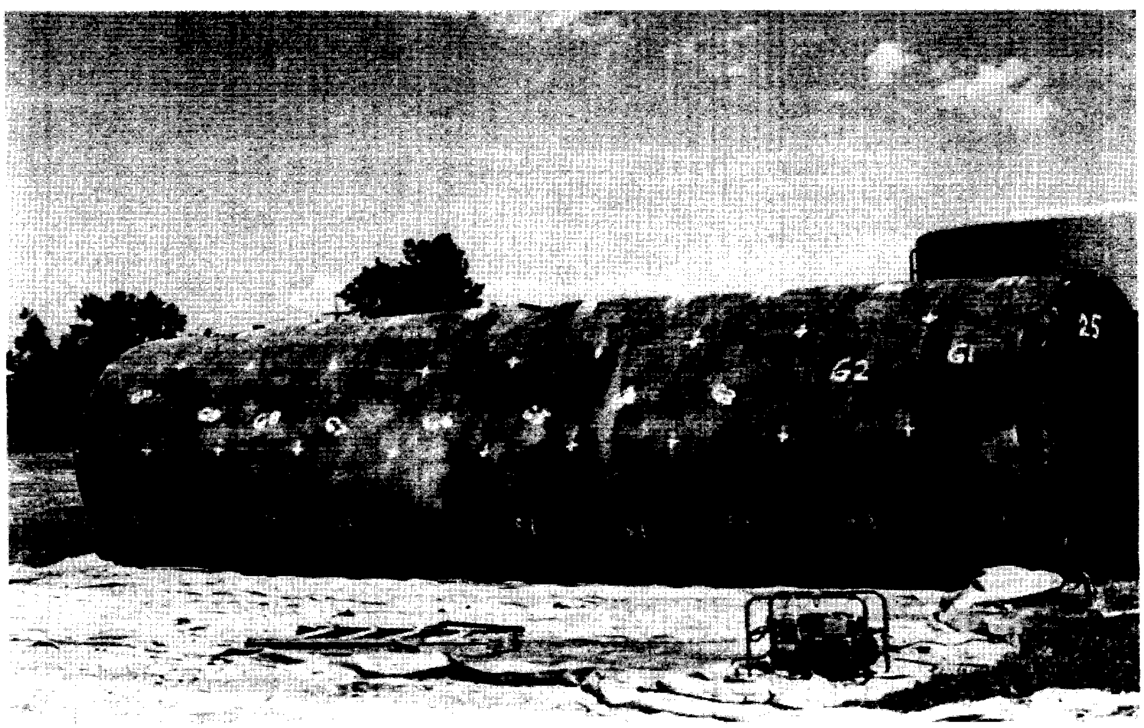


Figure 7 Tank 25 with External Grid and Damage from Removal

in Appendix C. All welds were found to be Type 1 continuous welds on both ends of the tank. The head joint welds were all of Type 18, continuous full fillet welds on the outside of the tank.

The external inspection identified a number of corrosion pits that were 0.10 inch deep or greater. The depth measurements for the six deepest external pits are presented in Table 2. The values reported are the average of triplicate measurements. The location of each pit is indicated by the reference grid. The location is specified by the grid letter around the tank and the location along the length, as well as the sub-grid within the grid. For example, B 1, 4-5 is in section B, closest to the open end, on the boundary between sub-grids 4 and 5. There were two pits at section C7-3 that were difficult to measure, as they were along a weld seam, one on each side. Both are reported in Table 2. All of these pits exceeded 50 percent of the nominal wall thickness of 0.250 inch. No perforations were found.

Table 2. Six Deepest External Pits on Tank 25

Grid Location	Pit depth
B1, 4-5	0.165
B6, 7	0.160
B10, 5	0.145
C2, 3	0.155
C7, 3 Outside Weld	0.199
C7, 3 Inside Weld	0.192

The five deepest internal pits were measured in triplicate and the average depths are reported in Table 3. The deepest of these approached 50 percent of the wall thickness, but did not reach it.

Table 3. Five Deepest Internal Pits on Tank 25

Grid Location	Pit depth
D10, 9	0.097
D9, 8	0.071
E10, 3	0.103
E10, 5	0.065
El, 2	0.102

Ultrasonic wall thickness measurements were made from the interior of the tank. Two grid sections, A8 and H5, gave initial measurements that were less than 85 percent of the minimum required wall thickness. The measurements at the center points for grid locations A8 and H5 were 0.207 and 0.183, respectively. These two grid areas were subdivided into 9 sub-grid areas and additional ultrasonic measurements were taken in each sub-grid. The average of the 9 readings was used to determine the wall thickness for that grid. The average of all side wall thickness measurements was 0.249 inch for Tank 25. The average of the wall thickness measurements on the end caps was 0.272 inch. The average wall thickness computed over both the end caps and the side walls was 0.252 inch. The thinnest measurement of the ultrasonic survey was 0.096 inch for a point located in grid area H5. However, when all the measurements in that grid were averaged, it was determined that the average thickness was 0.236 inch. None of the 3-ft by 3-ft grids averaged less than 85 percent of the required minimum wall thickness of 0.204 inch.

Ultrasonic wall thickness measurements were also made from the inside of Tank 25 at the location of the deepest external pits. To determine the minimum thickness in these areas triplicate measurements were made. The average wall thickness in the area of the pits identified in Table 2 is presented in Table 4. The minimum, single-point individual measurement for wall thickness was 0.072 inch.

Table 4. Ultrasonic Wall Thickness at the Six Deepest External Pits on Tank 25

Location	Remaining wall thickness
B1, 4-5	0.085
B6, 7	0.099
B10, 5	0.091
c2, 3	0.097
C7, 3 Outside Weld	0.084
C7. 3 Inside Weld	0.089

Section 6
Results, Conclusions, and Recommendations

6.1 Results

As specified in the QAPP, three criteria must be met for a tank to be considered suitable for upgrading with cathodic protection.

Criteria 1. The tank must be free of corrosion holes. Any perforation will disqualify that tank.

Criteria 2. There must be not be pits deeper than 0.5 times the required minimum wall thickness and the average wall thickness in each 3 ft by 3 ft area must be at least 85 percent of the required minimum wall thickness. A tank is unsuitable if either of these conditions is not met. (The required minimum wall thickness varies with the size of the tank, but is generally 0.240 inch.)

Criteria 3. The tank must be free of corrosion holes and cracks or separations in the tank welds.

A summary of the baseline test results for the five tanks included in the study is presented in Table 5. Each tank has been classified as either suitable or unsuitable for upgrading according to each of the three criteria specified above. In addition, the maximum pit depth, the minimum wall thickness, and the average wall thickness is reported for each tank.

Table 5. Summary of Baseline Test Findings

Tank No.	Max. pit depth	Average wall Thickness	Min. Wall Thickness	Suitability for Upgrading by Baseline Test Criteria			
				1	2	3	Overall
18	Perf.	0.250[a]	0.0	No	No	No	No
19	Perf.	0.256[a]	0.0	No	No	No	No
20	Perf.	0.257[a]	0.0	No	No	No	No
24	Perf.	0.246[a]	0.0	No	No	No	No
25	0.198	0.252	0.207[b]	Yes	No	Yes	No

[a] Ultrasonic measurements were abbreviated, since a perforation was found.
[b] Minimum ultrasonic survey reading based on grid location averages. Minimum wall thickness at a deep pit was 0.072 inch.

A summary of the results obtained by each technology evaluated is presented in Table 6. The baseline test results are also included. Two of the modeling methods evaluated the site as a whole, rather than individual tanks; WR/CRP considered the study as two separate sites, while ILFC considered the site as a single site.

Table 6. Summary of Technology Demonstrations

Tank No.	Conclusion Based on Technology Demonstration					Conclusion Based on Baseline Test
	Modeling			Remote Video	Internal Inspection	
	ILFC1	WR/CRP2	SCP3	TKNL Video4	AS5	
18	No[a]	No	No	No	No	No
19	No	No	No	No	No	No
20	No	No	No	No	No	No
24	No	No	No	No	No	No
25	No	No	No	No	No	No

a A "No" conclusion indicates that the tank is not suitable for upgrading by cathodic protection.

Notes:

1. ILFC (International Lubrication and Fuel Consultants) concluded that all tanks were electrically continuous and evaluated the five tanks as a single site.

2. WR/CRP (Warren Rogers/Corrpro) concluded that neither excavation (north or south of the vault) is suitable for upgrading with cathodic protection and the site does not qualify. They noted that their results are on a site specific basis rather than on a tank specific basis.

3. SCP (Southern Cathodic Protection) concluded that none of the tanks meets the criterion for upgrading because each tank's estimated mean time to corrosion failure is less than the age of the tank.

4. TKNL (Tanknology) concluded that further investigation and possibly repairs were necessary before any of the tanks could be upgraded by adding cathodic protection. Video log indicates possible penetration on Tank #19, possible pinholes in Tank #20, and pinhole ingress on Tank #18, with suspect areas noted on Tank #24 and Tank #25.

5. AS (Armor Shield) reported on the basis of an internal inspection that Tanks 18, 19, and 20 were not suitable because of perforations through the tank walls. Tanks 24 and 25 were not suitable because of pits that were more than 50 percent of the wall thickness (i.e., greater than 0.12 inch).

6.2 Conclusions and Recommendations

Application of each of the three technologies resulted in the determination that none of the tanks were suitable for upgrading with cathodic protection. The same conclusion was reached as a result of the baseline testing. Therefore, in this very limited demonstration/ assessment, each of the alternate technologies was successful in assessing whether the five test tanks were suitable for upgrading with cathodic protection. Because this study involved a very small number of tanks at a single site, extrapolation of these results beyond this project cannot be made.

This study demonstrated that all of the assessment techniques were applied according to the applicable standard and correctly identified the subject site(s) and tanks as not suitable for upgrading with cathodic protection. The combination of limited funding and the difficulty encountered in this study with finding sites with representative tanks limited the information available from the tests. Most of the candidate sites identified during the study contained old tanks suspected of being in poor condition. The age of the tanks (52 years) at the study site made the evaluations and decisions regarding upgrading suitability very straightforward for the experts applying the technologies. The study was far too small to provide statistically valid conclusions about the methods' performance. Accordingly, further study is needed to evaluate the performance of the methods.

Based on the above conclusions, further study is recommended to significantly expand the scope of work of this project. The expanded study should incorporate the following components to allow a statistically valid evaluation of the alternate technologies for determining the suitability of tanks for upgrading:

- Sites in five geographic regions of the United States
- 100 total (95 additional tanks) tanks, about 20 tanks per region
- Representative sites where tanks are actually being considered for upgrading
- Inclusion of the robotic ultrasonic technology, when it is commercially available.

Appendix A

Tank Tightness Test Reports

INVOICE #KK000248 TEST DATE: 07/21/96

RANGER PETROLEUM
PO BOX 1283
BLUE SPRINGS, MO 64013
(816)625-7255

TANK STATUS EVALUATION REPORT

* ***** CUSTOMER DATA ***** ***** SITE DATA * *****

MIDWEST RESEARCH INSTITUTE	NEWCENTURY AIRCENTER
425 VOLKER BLVD	1 NEW CENTURY PARKWAY
	SITE B
KANSAS CITY, MO	NEW CENTURY, KS
64110-2299	66031
CONTACT: FLORA, JERRY	CONTACT:
PHONE #: (816)753-7600	PHONE #:

***** COMMENT LINES *****

COPY TO KDHE

CURRENT EPA STANDARDS DICTATE
THAT FOR UNDERGROUND FUEL TANKS, THE MAXIMUM ALLOWABLE LEAK/GAIN RATE
OVER THE PERIOD OF ONE HOUR IS .10 GALLONS.

TANK #18: WATER TYPE: STEEL RATE: .665479 G.P.H. LOSS

TANK IS NOT TIGHT.

TANK #19: WATER TYPE: STEEL RATE: .016356 G.P.H. LOSS

TANK IS TIGHT.

OPERATOR: K L Koch SIGNATURE: [signature] DATE: 7/22/96

******* T A N K D A T A *********

	TANK NO. 18	TANK NO. 19	TANK NO. 3	TANK NO. 4
TANK DIAMETER (IN)	96	96		
LENGTH (FT)	31.67	31.67		
VOLUME (GAL)	11907	11907		
TYPE	ST	ST		
FUEL LEVEL (IN)	87	88		
FUEL TYPE	WATER	WATER		
dVOL/dy (GAL/IN)	92.06	87.29		

CALIBRATION ROD	DISTANCE	
1	10.6563	10.6563
2	26.9531	26.9531
3	41.9375	41.9375
4	56.9375	56.9375
5	74.9375	74.9375
6	.0000	.0000
7	.0000	.0000
8	.0000	.0000

******* CUSTOMER DATA ********

JOB NUMBER : 000248
CUSTOMER (COMPANY NAME) : MIDWEST RESEARCH INSTITUTE
CUSTOMER CONTACT(LAST, FIRST): FLORA, JERRY
ADDRESS - LINE 1 : 425 VOLXER BLVD
ADDRESS - LINE 2 :
CITY, STATE : KANSAS CITY, MO
ZIP CODE (XXXXX-XXXX) : 64110-2299
PHONE NUMBER (XXX)XXX-XXXX : (816)753-7600

******* COMMENT LINES *******

COPY TO KDHE

******* SITE DATA ********

SITE NAME (COMPANY NAME) : NEW CENTURY AIR CENTER
SITE CONTACT(LAST, FIRST) :
ADDRESS - LINE 1 : 1 NEW CENTURY PARKWAY
ADDRESS - LINE 2 : SITE B
CITY, STATE : NEW CENTURY, KS
ZIP CODE (XXXXX-XXXX) : 66031
PHONE NUMBER (XXX)XXX-XXXX :

GROUND WATER LEVEL (FT) : 0

NUMBER OF TANKS : 2

LENGTH OF PRE-TEST (MIN) : 30
LENGTH OF TEST (MIN) : 240

INVOICE #KK000249 TEST DATE: 07/22/96

RANGER PETROLEUM
PO BOX 1283
BLUE SPRINGS, MO 64013
(816)625-7255

TANK STATUS EVALUATION REPORT

***** CUSTOMER DATA • ****	***** SITE DATA • ****
MIDWEST RESEARCH INSTITUTE	NEW CENTURY AIR CENTER
425 VOLKER BLVD	1 NEW CENTURY PARKWAY
	SITE B
KANSAS CITY, HO	NEW CENTURY, KS
64110-2299	66031
CONTACT : FLORA, JERRY	CONTACT:
PHONE #: (816)753-7600	PHONE #:

• **** COMMENT LINES • ****

COPY TO XDHE

CURRENT EPA STANDARDS DICTATE
THAT FOR UNDERGROUND FUEL TANKS, THE MAXIMUM ALLOWABLE LEAK/GAIN RATE
OVER THE PERIOD OF ONE HOUR IS .10 GALLONS.

TANK 120: WATER	TYPE: STEEL	RATE: . 343578 G.P.H. LOSS
	TANK IS NOT TIGHT.	
TANK #21: WATER	TYPE: STEEL	RATE: . 110466 G.P.H. LOSS
	TANK IS NOT TIGHT.	

OPERATOR: K L Kell SIGNATURE: Ken Kell DATE: 7/22/96

******* T A N K   D A T A ********

	TANK NO. 20	TANK NO. 21	TANK NO. 3	TANK NO. 4
TANK DIAMETER (IN)	96	96		
LENGTH (FT)	31.67	31.67		
VOLUME (GAL)	11907	11907		
TYPE	ST	ST		
FUEL LEVEL (IN)	88	90.5		
FUEL TYPE	WATER	WATER		
dVCL/dy (GAL/IN)	87.29	73.40		

CALIBRATION ROD	DISTANCE	
1	10.6563	10.6563
2	26.9531	26.9531
3	41.9375	41.9375
4	56.9375	56.9375
5	74.9375	74.9375
6	.0000	.0000
7	.0000	.0000
a	.0000	.0000

******* C U S T O M E R   D A T A ********

JOB NUMBER	:	000249
CUSTOMER (COMPANY NAME)	:	MIDWEST RESEARCH INSTITUTE
CUSTOMER CONTACT(LAST, FIRST)	:	FLORA, JERRY
ADDRESS - LINE 1	:	425 VOLKER BLVD
ADDRESS - LINE 2	:	
CITY, STATE	:	KANSAS CITY, MO
ZIP CODE (XXXXX-XXXX)	:	64110-2299
PHONE NUMBER (XXX)XXX-XXXX	:	(816)753-7600

******* C O M M E N T   L I N E S *******

COPY TO KDHE

******* S I T E   D A T A ********

SITE NAME (COMPANY NAME)	:	NEW CENTURY AIR CENTER
SITE CONTACT(LAST, FIRST)	:	
ADDRESS - LINE 1	:	1 NEW CENTURY PARKWAY
ADDRESS - LINE 2	.	SITE B
CITY, STATE	:	NEW CENTURY, KS
ZIP CODE (XXXXX-XXXX)	:	66031
PHONE NUMBER (XXX)XXX-XXXX	:	
GROUND WATER LEVEL (FT)	:	0
NUMBER OF TANKS	:	2
LENGTH OF PRE-TEST (MIN)	:	30
LENGTH OF TEST (MIN)	:	240

INVOICE #KK000247 TEST DATE: 07/19/96

RANGER PETROLEUM
PO BOX 1283
BLUE SPRINGS, MO 64013
(816)625-7255

TANK STATUS EVALUATION REPORT

• **** CUSTOMER DATA • ****

MIDWEST RESEARCH INSTITUTE
425 VOLKER BLVD.

KANSAS CITY, HO
64110-2299

ZONTACT: FLORA, JERRY
PHONE #: (816)753-7600

***** SITE DATA •

NEW CENTURY AIR CENTER
1 NEW CENTURY PARKWAY
SITE B
NEW CENTURY, KS
66031

CONTACT:
PHONE #:

• **** COMMENT LINES • ****

COPY TO KDHE

CURRENT EPA STANDARDS DICTATE
THAT FOR UNDERGROUND FUEL TANKS, THE MAXIMUM ALLOWABLE LEAK/GAIN RATE
OVER THE PERIOD OF ONE HOUR IS .10 GALLONS.

CANK #24: WATER	TYPE: STEEL TANK IS NOT TIGHT.	RATE: .073991 G.P.H. LOSS
TANK X25: WATER	TYPE: STEEL TANK IS NOT TIGHT.	RATE: .102721 G.P.H. LOSS

OPERATOR: KL Keck SIGNATURE: [signature] DATE: 7/19/96

******* T A N K D A T A ********

	TANK NO. 24	TANK NO. 25	TANK NO. 3	TANK N
TANK DIAMETER (IN)	96	96		
LENGTH (FT)	31.67	31.67		
VOLUME (GAL)	11907	11907		
TYPE	ST	ST		
FUEL LEVEL (IN)	89.5	89		
FUEL TYPE	WATER	WATER		
dVOL/dy (GAL/IN)	79.35	82.11		
CALIBRATION ROD	DISTANCE			
1	10.6563	10.6563		
2	26.9531	26.9531		
3	41.9375	41.9375		
4	56.9375	56.9375		
5	74.9375	74.9375		
6	.0000	0000		
7	.0000	: 0000		
8	.0000	.0000		

******* C U S T O M E R   D A T A ********

JOB NUMBER	: 000247
CUSTOMER (COMPANY NAME)	: MIDWEST RESEARCH INSTITUTE
CUSTOMER CONTACT(LAST, FIRST)	: FLORA, JERRY
ADDRESS - LINE 1	: 425 VOLKER BLVD.
ADDRESS - LINE 2	:
CITY, STATE	: [illegible] CITY, MO
ZIP CODE (XXXXX-XXXX)	: 64110-2299
PHONE NUMBER (XXX)XXX-XXXX	: (816)753-7600

******* C O M M E N T   L I N E S *******

COPY TO KDHE

******* S I T E   D A T A ********

SITE NAME (COMPANY NAME)	: NEW CENTURY AIR CENTER
SITE CONTACT(LAST, FIRST)	:
ADDRESS - LINE 1	: 1 NEW CENTURY PARKWAY
ADDRESS - LINE 2	: SITE B
CITY, STATE	: NEW CENTURY, KS
ZIP CODE (XXXXX-XXXX)	: 66031
PHONE NUMBER (XXX)XXX-XXXX	:
GROUND WATER LEVEL (FT)	:
NUMBER OF TANKS	: 2
LENGTH OF PRE-TEST (MIN)	: 30
LENGTH OF TEST (MIN)	: 240

Appendix B

Technology Vendor Reports

International Lubrication and Fuel Consultants Inc.
Creating the standards for industry.

P.O. Box 15212
Rio Rancho, NM 87174
(505) 892-1666 (800) 237-4532
Fax (505) 892-9601

ILFC, INC. TEP ANALYSIS REPORT NO. 50-806

DATE: August 14, 1996

FOR: Midwest Research Institute
425 Volker Blvd.
Kansas City, MO 64110

SITE ID: New Century
1 New Century Parkway
New Century, KS 66031

TEPH (Total Extractable Petroleum Hydrocarbons) concentrations are listed on the site map, Analyses show the presence of petroleum hydrocarbons, classified as very aged diesel fuel, in most of the soil samples taken around these fuel systems.

Half-ceil measurements which were taken between these fuel systems and their surrounding soil indicate that there is a significant amount of steel structure remaining in good condition in regards to corrosion.

The Class IV CH (inorganic clays of high plasticity, fat clays) soil has an average pH of 8 (alkaline), an average moisture content of 18.5%, an average bacteria count of 50.000 spores/ml, average soil resistivity of 1.400 ohm-cm, an average chloride content of 2 ppm and a sulfide concentration of 497 ppm.

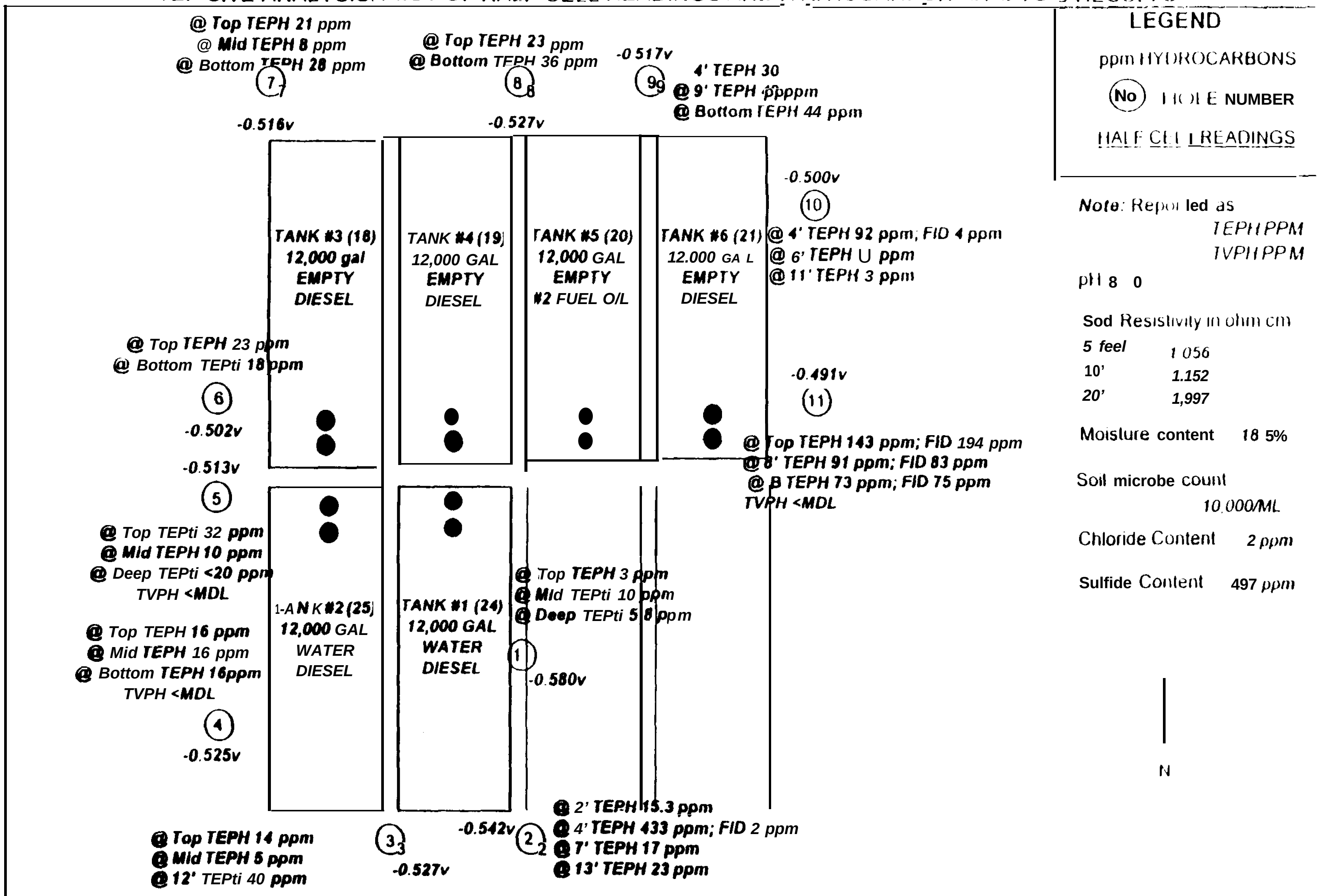
Based on the field investigation and laboratory analyses performed on this site it appears these fuel systems do not meet satisfactory TEP and/or ASTM ES 40-94 critena. ILFC, inc. strongly recommends investigating the source of contamination and providing us with the tank tightness testing history of this site. We will re-evaluate this site as soon as we receive this information. In the interim if we can be of any further assistance or if more information regarding our field investigation and/or laboratory analyses is needed please do not hesitate to contact us at (800) 237-4532.

Ray Kashmiri
Petroleum\Corrosion Engineer

George H. Kitchen
President

INTERNATIONAL LUBRICATION & FUEL CONSULTANTS, INC. Rio Rancho, New Mexico 87124 (800) 237 45 32

TEP SITE ANALYSIS: PLOT OF HALF-CELL READINGS AND HYDROCARBON ANALYSIS RESULTS



DATE ON SITE: 7/18/96 **DATE OF ANALYSIS:** 7/24/96	**SITE:** New Century 1 New Century Parkway New Century, KS 66031	**CLIENT:** Midwest Research Institute 425 Volker Blvd Kansas City, MO 641 10	**Drawing No.** MRI - TEP New Century Airport **Drawn By:** K B and J W **Date:** 7/22/96

Site: New Century Airport
Batch No: 96275

	1-T	2-2'	2-4'	2-7'	2-13'	5-T	5-M	5-B	11-T	11-M	11-B
% Moisture	24.30%	14.60%	17.00%	18.40%	19.20%	16.50%	20.50%	16.80%	16.90%	20.60%	18.70%
Bacteria	10,000/ml	10,000/ml	100,000/ml	100,000/ml	1,000/ml	1,000/ml	1,000/ml	100,000/ml	1,000,000/ml	100,000/ml	100,000/ml
Chloride (ppm)	3.3	1.1	1.1	<1	1.7	<1	<1	1.2	1	1.2	1.2
pH	8.2	7.7	8.2	8.1	8.6	8.3	7.9	7.9	7.8	7.9	7.8
Soil Type	IV CH	IV CH	IV CH	IV CH	IV CH	IV CH	IV CH	IV CH	IV CH	IV CH	IV CH
SRB	$10^2 - 10^3$	$>10^3$	$>10^3$	$>10^3$	$<10^2$	$<10^2$	$10^2 - 10^3$	$<10^2$	$10^2 - 10^3$	$>10^3$	$>10^3$

International
lubrication and
Fuel Consultants Inc.
Creating the standards for industry.

P.O. Box 15212
Rio Rancho, NM 87174
(505) 892-1666 (800) 237-4532
Fax (505) 892-9601

November 5. 1996

Mr. Robert L. Hoye
Project Manager
IT Corporation
11499 Chester Road
Cincinnati, OH 45246

REF: New Century Air Center EPA Contract No. 68-C2-0 108

Dear Mr. Hoye:

Thank you for the information sent to us on November 1, 1996. Due to the fact that the tanks at this site are electrically continous and therefore considered one unit, we will not revise our original conclusion that the fuel systems at this site do not meet satisfactory TEP and/or ASTM ES JO-94 criteria.

S incereiy ,

Ray Kashmiri
Petroleum/Corrosion Engineer

cc: J. Flora

Warren Rogers Associates. Inc.

October 25, 1996

Mr. Bob Hoye
IT Corporation
11499 Chester Road
Cincinnati, OH

Re: US EPA Research Project "Evaluation of Technologies for Upgrading UST Systems"; Contract 68-C2-0108. WA 4-17, JTN 76439

Dear Mr. Hoye:

Please find attached the results of the MTCF™ analysis of the two UST excavations in Kansas City where representatives of Con-pro conducted field measurements and observations. Based upon your recent telephone conversation with Warren regarding the site specific nature of the MTCF™ procedure, it is our understanding that a footnote regarding the site specific nature of the analysis is to be provided with Table l-l of the QAPP.

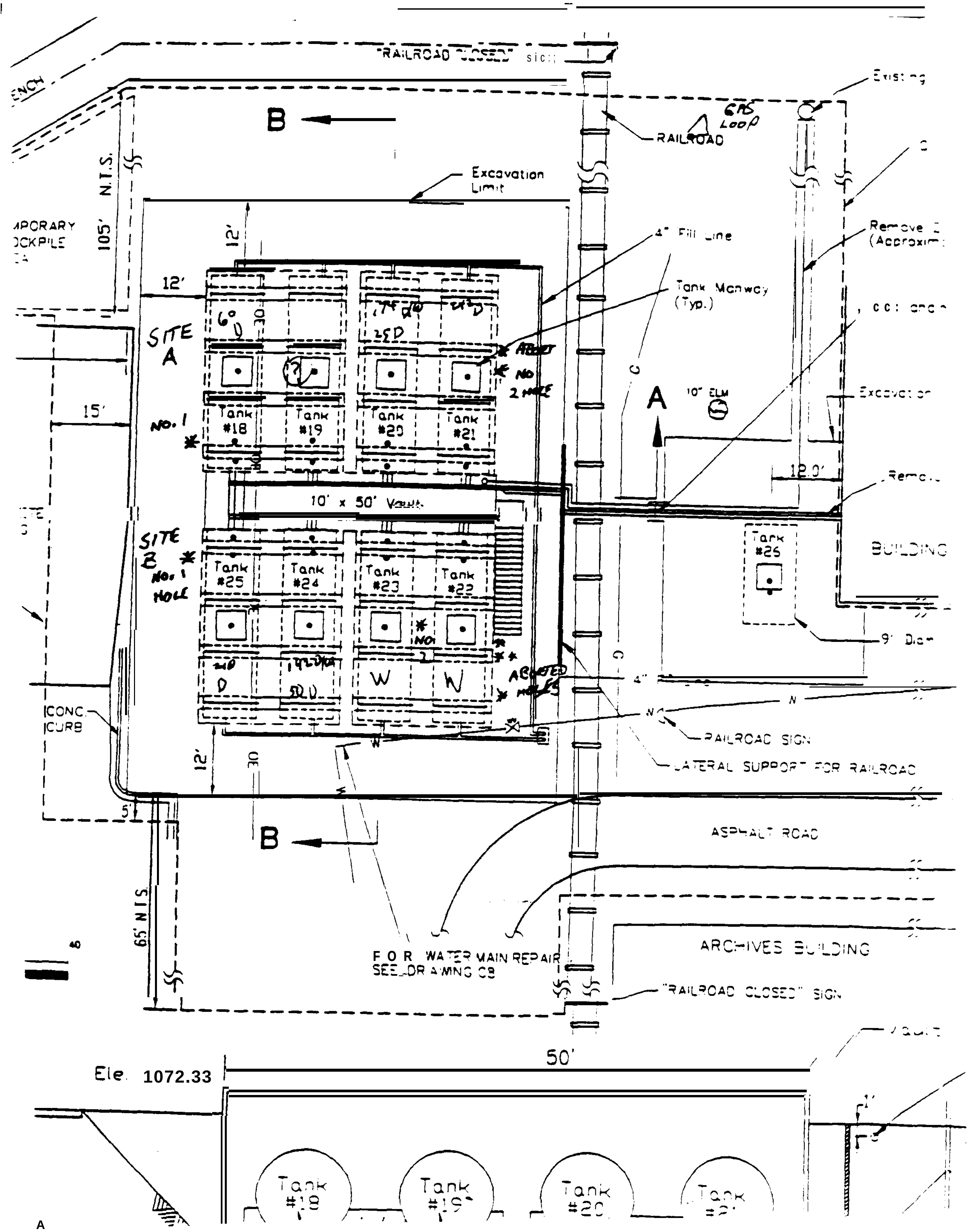
As you'll note, cathodic protection upgrade is not considered a viable option for either site (excavation). In addition to the high probability of failure. the presence of a nearby cathodically protected structure and the fact that the UST's are likely resting on a concrete pad preclude consideration of cathodic protection retrofit at either of these sites. Regardless of the results of the prior leak detection testing. the recommendation that these tanks not be considered for cathodic protection upgrade will stand.

If you have any questions or comments, please call.

Sincerely,

William P. Jones
Executive Vice President

747 Aquidneck Avenue Middletown. Rhode island 02842 (401) 846-4747 Fax (401) 847-8170


"RAILROAD CLOSED" sign
B
RAILROAD
Existing
Excavation Limit
N.T.S.
105'
12'
4" Fill Line
Tank Manway (Typ.)
Remove
SITE A
Tank #18
Tank #19
Tank #20
Tank #21
A
10" ELM
Excavation
15'
12.0'
10' x 50' Vault
SITE B
Tank #25
Tank #24
Tank #23
Tank #22
Tank #26
BUILDING
9' Diam
CONC. CURB
RAILROAD SIGN
LATERAL SUPPORT FOR RAILROAD
ASPHALT ROAD
65' N.T.S.
FOR WATER MAIN REPAIR SEE DRAWING C3
ARCHIVES BUILDING
"RAILROAD CLOSED" SIGN
50'
Ele. 1072.33

WRA M.T.C.F. [*] *- Corrosion Failure*

Prepared by: Corrpro Companies, Inc.
610 Brandywine Parkway, West Chester, PA

Prepared on October 15. 1996 for
EPA TEST SITE

Location ID **EPAKSA**
EPAKSA
ROLAND PARK DR (BLDG 14)
NEW CENTURY, KS

Operator ROBERT HILGER
913-782-5338

PROBABILITIES AND TANK INFORMATION

Location Name	Conditional Probability of Corrosion Failure Given Pitting Corrosion			Probability of Localized Corrosion		Mean Time to Corrosion Failure	Tank Age
	Present	Present if saturated	Future	Present	Future	(Expected Leak Free Life if pitting corrosion exists)	
EPAKSA	0 999	N/A	0999	N/A	N/A	11.8	52 00

RECOMMENDATION

The percent probability of corrosion failure precludes consideration of this site for cathodic protection retrofit The existence of a nearby cathodicalty protected structure militates against prolonged lank life This site does <u>not</u> meet ASTM ES-40 94 criteria for upgrading by cathodic protectron

Tank #	Location	Gallons	Dimensions	Year Installed	Tank Type	Product	Bottom -Depth (Inches)	Internal Water	Internal Corrosion	Information Confirmation'	Isolated (Y/N)
1	NW #18	12000	96X384	12/31/44	Steel	DSL	121	1.00	Smooth	1	N
2	NWC #19	12000	96X384	12/31/44	Steel	DSL		0.00		1	N
3	NEC #20	12000	96X384	12/31/44	Steel	FO	121	4.00	Smooth	1	N
4	NE #21	12000	96X384	12/31/44	Steel	D/W	121	3.75	Smooth	1	N

'-Confirmation: 1=Same as Company Information, 2=Different than Company Information

Engineer. G E ALBRECHT

rev 11/15/95

SITE INFORMATION

Active Electrical Plant Nearby? Type of System; Distance in feet?	N	Overspill containment on site?	N
Cathodically protected structures nearby?; Distance in feet?	Y-	Monitoring wells on site?	N
Utility vault or conduit nearby?		Leak history available on site?	N
Potable water well nearby7	N	Repair history available on sb?	N
Waterway. stream or lake nearby?	N	Site plans available on site?	Y
Line leak detectors installed?	N	Installation specs available on site?	N
Piping material7	S	Type of pump?	S

LABORATORY INFORMATION

Moisture Content (% Dry Weight)	pH	Conductlvlty (micromhos)	Sulphides (ppm)	Chlorides (ppm)
27 03% - 30 73%	7 2 - 8 5	230 - 568	0000-0000	1- 6

Moisture tested as to ASTM D22 16 80 pH tested as to ASTM D2476 71 Conductivity tested as to APHA 120 1 Sulphides tested as to EPA 371 1 Chlorides tested as to ASTM D516 81

ON SITE SOIL SAMPLE ANALYSIS

SAMPLE LOCATION (HOLE #)	DEPTH (FT)	SQUEEZE MOISTURE TEST (YES/NO)	GROUND WATER LEVEL (FEET)	TYPE OF BACKFILL'
1 TOP	2	N		3
MIDDLE	6	N		3
BOTTOM	10	Y	7	3
2 TOP	2	N		3
MIDDLE	6	Y	6	3
BOTTOM	10	Y		3
3 TOP				
MIDDLE				
BOTTOM				
4 TOP				
MIDDLE				
BOTTOM				

Type of Backfill 1=Sand 2=Native Soil 3=Clay 4=Rubble 5=Pea Gravel 6 Other or Combination

ON SITE HOLE PROFILE

HOLE #1 - POTENTIAL AND RESISTIVITY PROFILE			HOLE #2 - POTENTIAL AND RESISTIVITY PROFILE			HOLE #3 - POTENTIAL AND RESISTIVITY PROFILE			HOLE #4 - POTENTIAL AND RESISTIVITY PROFILE		
DEPTH (FT)	POTENTIAL (NV)	RESISTANCE (OHM-CM)	DEPTH (FT)	POTENTIAL (NV)	RESISTANCE (OHM-CM)	DEPTH (FT)	POTENTIAL (NV)	RESISTANCE (OHM-CM)	DEPTH (FT)	POTENTIAL (NV)	RESISTANCE (OHM-CM)
2	-520 00	630 00	2	-525 00	924 00			0.00			0.00
4	-527 00	714 00	4	-525 00	924 00			0.00			0.00
6	-538 00	840 00	6	-527 00	924 00			0.00			0.00
8	-543 00	882 00	8	-524 00	1176 00			0.00			0.00
10	-549 00	0 00	10	-523 00	0 00			0.00			0.00
		0 00			0.00			0.00			0.00
		0 00			0.00			0.00			0.00
		0 00						0.00			0.00

rev 11/14/95

Prepared by: Corrpro Companies, Inc.
610 Brandywine Parkway, West Chester, PA

Prepared on October 15. 1996 for
EPA TEST SITE

Location ID **EPAKSB**
EPAKSA
ROLAND PARK DR (BLDG 14)
NEW CENTURY, KS

Ooerator ROBERT HILGER
913-762-5336

PROBABILITIES AND TANK INFORMATION

Location Name	Conditional Probability of Corrosion Failure Given Pitting Corrosion			Probablity of Localized Corrosion		Mean Time to Corrosion Failure	lank Age
	Present	Present if saturated	Future	Present	Future	(Expected Leak Free Life if pitting corrosion exists)	
EPAKSA	0.999	N/A	0 999	N/A	N/A	130	52 00

RECOMMENDATION

The present probability of corrosion failure precludes consideration of this site for cathodic protection retrofit The existence of nearby cathodiilly protected structures militates against prolonged lank life This site does not meet ASTM ES 40-94 criteria for upgrading by cathodic protection retrofit

Tank #	Location	Gallons	Dimensions	Year Installed	Tank Type	Product	Bottom -Depth (Inches)	Internal Water	Internal Corrosion	Information Confirmation'	Isolated (Y/N)
1	SW #25	12000	96X384	12/31/44	Steel	DSL	122	025	Smooth	I	N
2	SWC #24	12000	96X384	12/31144	Steel	DSL	123	075	Smooth	1	N
3	SEC #23	12000	96X384	12/31/44	Steel	DSL	121	0.00	Rough	1	N
4	SE #22	12000	96X384	12/31/44	Steel	D/W	121	000	Smooth	I	N

'-Confirmation: 1=Same as Company Information, 2=Different than Company Information

Engineer G E ALBRECHT

SITE INFORMATION

Active Electrical Plant Nearby? Type of System; Distance in feet?	N	Overspill containment on site?	N
Cathodically protected structures nearby?; Distance in feet?	Y-25	Monitoring wells on sne?	N
Utility vault or conduit nearby?		Leak history available on site?	N
Potable water well nearby?	N	Repair history available on rite?	N
Waterway, stream or lake nearby?	N	Site plans available on site?	Y
Line leak detectors installed7	N	Instalbtion specs availabb on site?	N
Pioino material?	S	Tvoe of pump?	S

LABORATORY INFORMATION

Moisture Content (% Dry Weight)	pH	Conductivity (mlcromhos)	Sulphides (ppm)	Chlorides (ppm)
20 05% - 41 11%	7.0 - 8 2	121 -458	0000-0000	1- 2

Moisture tested as to ASTM D22 16 80 | pH tested as to ASTM D2476 71 | Conductivity tested as to APHA 120 1 | Sulphides tested . . to EPA 3711 | Chlorides tested as to ASTM D516 81

ON SITE SOIL SAMPLE ANALYSIS

SAMPLE LOCATION (HOLE #)	DEPTH (FT)	SQUEEZE MOISTURE TEST (YES/NO)	GROUND WATER LEVEL (FEET)	TYPE OF BACKFILL'	SAMPLE LOCATION (HOLE #)	DEPTH (FT)	SQUEEZE MOISTURE TEST (YES/NO)	GROUND WATER LEVEL (FEET)	TYPE OF BACKFILL'
1 TOP	2	N		3	3 TOP				
MIDDLE	6	N		3	MIDDLE				
BOTTOM	10	Y	7	3	BOTTOM				
2 TOP	2	N		3	4 TOP				
MIDDLE	6	Y	6	3	MIDDLE				
BOTTOM	10	Y		3	BOTTOM				

Type of Backfill 1=Sand 2=Native Soil 3=Clay 4=Rubble 5=Pea Gravel 6=Other or Combination

ON SITE HOLE PROFILE

HOLE #1. POTENTIAL AND RESISTIVITY PROFILE			HOLE #2. POTENTIAL AND RESISTIVITY PROFILE			HOLE #3 - POTENTIAL AND RESISTIVITY PROFILE			HOLE #4 - POTENTIAL AND RESISTIVITY PROFILE		
DEPTH (FT)	POTENTIAL (NV)	RESISTANCE (OHM-CM)	DEPTH (FT)	POTENTIAL (NV)	RESISTANCE (OHM-CM)	DEPTH (FT)	POTENTIAL (NV)	RESISTANCE (OHM-CM)	DEPTH (FT)	POTENTIAL (NV)	RESISTANCE (OHM-CM)
2	-520 00	630 00	2	-525 00	924 00						
4	-527 00	714 00	4	-525 00	924 00						
6	-530 00	840 00	6	-52700	924 00						
8	-543 00	882 00	8	-52400	117600						
10	-54900	0 00	10	-523 00	000						

rev 11-14 95

STRAY CURRENT ANALYSIS

# OF READINGS TAKEN	MOST POSITIVE	AVERAGE	MOST NEGATIVE	FIRST	GREATER THAN +50	+50 TO +41	+40 TO +31	+30 TO +21	+20 TO +11	+10 TO 0	-10 TO -1	-11 TO -20	-21 TO -30	-31 TO -40	-41 TO -50	LESS THAN -50
263	531	530	-532	-530	0	0	0	0	0	262	1	0	0	0	0	0
262	532	-531	533	-531	0	0	0	0	0	256	6	0	0	0	0	0
261	533	532	534	-533	0	0	0	0	0	250	3	0	0	0	0	0
260	534	533	535	534	0	0	0	0	0	256	4	0	0	0	0	0
260	535	535	-535	-535	0	0	0	0	0	253	7	0	0	0	0	0
259	535	534	-536	-535	0	0	0	0	0	226	33	0	0	0	0	0
259	536	535	536	-535	0	0	0	0	0	256	3	0	0	0	0	0
257	536	-536	-537	-536	0	0	0	0	0	176	81	0	0	0	0	0
257	-536	-536	-537	-537	0	0	0	0	0	6	251	0	0	0	0	0
256	536	-536	-536	-536	0	0	0	0	0	227	31	0	0	0	0	0
256	-536	-536	-537	-536	0	0	0	0	0	95	161	0	0	0	0	0
255	-536	-536	-536	-536	0	0	0	0	0	30	225	0	0	0	0	0
255	536	-536	-536	-536	0	0	0	0	0	197	58	0	0	0	0	0
256	-536	-536	-537	-536	0	0	0	0	0	244	12	0	0	0	0	0
254	-537	-536	-537	-537	0	0	0	0	0	161	93	0	0	0	0	0
254	-537	-537	-537	-537	0	0	0	0	0	227	27	0	0	0	0	0
254	-537	-537	-538	-537	0	0	0	0	0	25	229	0	0	0	0	0
254	537	-537	-538	-537	0	0	0	0	0	254	0	0	0	0	0	0
254	536	-536	-530	-530	0	0	0	0	0	254	0	0	0	0	0	0
251	536	-537	-538	-530	0	0	0	0	0	26	225	0	0	0	0	0
253	536	537	-539	-537	0	0	0	0	0	251	2	0	0	0	0	0
252	538	536	-536	-536	0	0	0	0	0	210	42	0	0	0	0	0
250	530	-538	-530	-530	0	0	0	0	0	56	194	0	0	0	0	0
250	-538	-536	-538	-538	0	0	0	0	0	1	249	0	0	0	0	0
249	538	-537	-538	-530	0	0	0	0	0	75	174	0	0	0	0	0
249	537	-537	-538	-537	0	0	0	0	0	32	217	0	0	0	0	0
249	-537	537	-530	-537	0	0	0	0	0	136	113	0	0	0	0	0
246	-537	-530	-537	-537	0	0	0	0	0	1	247	0	0	0	0	0
240	-536	-536	-536	-536	0	0	0	0	0	43	205	0	0	0	0	0
247	536	-536	-536	-530	0	0	0	0	0	6	241	0	0	0	0	0

STRAY CURRENT ANALYSIS

#OF READINGS TAKEN	MOST POSITIVE	AVERAGE	MOST NEGATIVE	FIRST	GREATER THAN +50	+50 TO +41	+40 TO +31	+30 TO +21	+20 TO +11	+10 TO 0	-10 TO -1	-11 TO -20	-21 TO -30	-31 TO -40	-41 TO -50	LESS THAN -50
246	–535	--535	-536	– 536	0	0	0	0	0	1	245	0	0	0	0	0
246	– 535	-534	-535	– 535	0	0	0	0	0	9	237	0	0	0	0	0
246	-534	-534	-534	– 534	0	a	a	0	0	33	213	a	0	0	0	0
246	– 534	-534	– 534	-534	0	a	0	0	0	64	162	0	0	0	0	0
247	- 534	-634	-535	-534	0	0	0	0	0	239	6	0	0	0	0	a
246	– 535	– 535	-535	– 535	0	a	0	0	0	245	1	0	0	0	0	a
246	– 536	– 535	– 536	– 535	0	0	0	0	0	240	6	0	0	0	0	0
245	– 537	-536	– 539	-536	0	0	0	0	0	242	3	0	0	0	0	0
196	– 537	– 537	-536	– 537	0	0	0	0	0	172	24	0	0	0	0	0

SOUTHERN CATHODIC PROTECTION

August 29, 1996

Mr Jairus D. Flora, Jr., Ph.D
Senior Advisor for Statistics
Midwest Research Institute
425 Volker Boulevard
Kansas City, Missouri 64110

Reference: Statistical Corrosion Probability Analysis
Underground Storage Tank System
New Century Air Center, New Century, Kansas

Dear Mr. Flora

Enclosed please find a copy of the corrosion evaluation report which fails to meet the ASTM ES 40-94 standard, which is the minimum performance practice for alternative methods to internal inspection pursuant to API 1631 and NLPA 631 of inspecting and assessing buried steel tanks for corrosion damage and determining the suitability of these tanks for upgrading with cathodic protection in accordance with Volume 40 of the Code of Federal Regulations (CFR), Section 280.21 (b)(2)(iv).

The ages of the tanks exceeds the mean time to corrosion failure in years. Therefore, internal inspections are required in order to determine the suitability of the tank(s) for upgrading with cathodic protection.

Requirements far applying cathodic protection to tanks which have been evaluated using the ES 40-94 non-invasive procedures are as follows:

1) Tank is leak-free.
2) Tank age is less than the expected leak-free life.
3) The probability of corrosion perforation is less than 0.05.
4) For tanks upgraded with cathodic protection based on the results of the assessment procedure, monthly monitoring for releases in accordance with 40 CFR 5280.H3 (d) through (h) should be implemented within one month following the upgrade.

We trust you will find this information complete and satisfactory and look forward to working with you on this project.

Sincerely,

John L. Piazza II, P.E.
President

Enclosures

Center One Suite 1081 100 Johnson Ferry Road, N.E. . Atlanta, Georgia 30342
Phone. (404) 252-4649 · Fax: (404) 252-1824

SITE ANOMALIES

1. Steel natural gas pipeline east of tanks.
2. Water pipeline south and east of tanks.
3. Impressed current cathodic protection system northeast of tanks.
4. Tanks were heated internally with steam.
5. Tanks installed on concrete pad & on cradles.
6. Water table levels measured during site investigation is near bottom of tanks - see data sheets.
7. Water is standing in the vaults between tanks.
8. Fill tubes are pitted.
9. Tanks are pitted directly below fill tubes.
10. Water line is not electrically continuous.
11. Railroad track located east of tanks (no DC power located').
12. Water was observed in some of the tanks.

SCP REPORT

ASTM ES40-94

CLIENT: New Century Air Center
1 Yew Century Parkway
New Century. Kansas
(706) 882-3366

LOCATION: UST Site
1 New Century Parkway
New Century, Kansas

PAGE 1 OF 2

DATE: August 14.1996	Tk. No. & Capacity (gallons)	Tk. No. & Capacity (gallons)	Tk. No. & Capacity (gallons)	Tk. No. & Capacity gallons)
	Tank 18 - 12,000	Tank 19 - 13,000	Tank 20 - 12,000	Tank 21 - 12,000
Age	52	52	52	52
Material	Steel	Steel	Steel	Steel
Electrical Isolation	OK	OK	OK	OK
Product	Diesel	Diesel	Diesel/Fuel Oil	Diesel/ H_2O
Backfill Material	Concrete Pad/Unknown	Concrete Pad/Unknown	Concrete Pad/Unknown	Concrete Pad/Unknown
Coating/Lining	N/A	N/A	N/A	N/A
Leak History	N/A	N/A	N/A	N/A
Repair History	N/A	N/A	N/A	N/A
Taak Tightness Test/SIR	Not Available	Nor Available	Not Available	Not Available
Stray Current	N/D *	N/D *	N/D *	N/D *
Structure-to-soil Potentials (mv)	532	532	531	531
Soil Resistivity (ohm cm)	800	900	1,000	790
Moisture Content	21.7%	20%	20%	17.9%
Soil pH	7.4	7.4	7.6	7.6
Chloride ion conc.	51 ppm	51 ppm	44 ppm	44 ppm
Sulfide ion conc.	2.6 ppm	2.6 ppm	2.2 ppm	2.2 ppm
Internal Corrosion Check	Pined / H_2O in tanks May be leaking	Pitted / max 3/32"	Pitted	Pitted / sludge bottom
Mean Tie to Corrosion Failure in years	22.4	22.5	23.4	23.0
Probability of Corrosion Perforation	N/A	N/A	N/A	N/A
Assessment	Failed	Failed	Failed	Failed
Recommendations	Internal Inspection	Internal Inspection	Internal Inspection	Internal Inspection

Note(s): * Impressed current cathodic Protection system adjacent to tanks - no joint tests were performed.

Corrosion Tester JLP/JFF Quality Control JLP Corrosion Expert [signature]

SCP REPORT

ASTM ES40-94

CLIENT: New Century Air Center
1 New Century Parkway
New Century, Kansas

LOCATION: UST Site
1 New Century Parkway
New Century, Kansas

DATE: August 14, 1996	Tk. No. & Capacity (gallons)	Tk. No. & Capacity (gallons)	Tk. No. & Capacity (gallons)	Tk. No. & Capacity (gallons)
	Tank 25 - 12,000	Tank 24 - 12,000		
Age	52	52		
Mated	Steel	Steel		
Electrical Isolation	OK	OK		
Product	Diesel	Diesel		
Backfill Material	Concrete Pad/Unknown	Concrete Pad/Unknown		
Coating/Lining	N/A	N/A		
Leak History	N/A	N/A		
Repair **History**	N/A	N/A		
Tank Tightness **Test/SIR**	Not Available	Not Available		
Stray Current	N/D *	N/D *		
Structurtto-soil Potentials (mv)	529	529		
Soil Resistivity (ohm cm)	880	800		
Moisture Content	17.3%	20%		
Soil **pH**	7.2.	7.6		
Chloride ion **conc.**	9.9 ppm	15 ppm		
Sulfide ion **conc.**	3.2 ppm	3.6 ppm		
Internal Corrosion Check	Pitted / 1/8" max.	Pitted		
Mean Time to Corrosion Faiiure in years	11.9	33.0		
Probability of Corrosion **Perforation**	N/A	N/A		
Assessment	Failed	Failed		
Recommendations	Internal Inspection	Internal Inspection		

Note(s): * Impressed current cathodic protection system adjacent to tank - no joint tests were performed.

Corrosion Tester JLP'JFF Quality Control JL? Corrosion Expert

TANKNOLOGY®

TECHNOLOGY FOR TANKS AND THEIR ENVIRONMENT

September 12, 1996

Mr J 3 Flora
Midwest Research Institute
425 Volker Boulevard
Kansas City, Missouri 6411 Z-2299

Subject: Corrosion Site Survey Report
Petroscope" Internal Visual Inspection Report
Johnson County Industrial Airport
Building #14 UST Facility
1 New Century Parkway
New Century Kansas
Eight (8) 12,000-Gallon USTs
One (1) 5,000-Gallon UST

Dear Mr Flora:

On July 29 and 30. 1996, Tanknology Corporation international conducted a Petroscope" Internal Visual Inspection and Corrosion Site Survey on Johnson County Industrial Airport. Building #14 UST facility. The reports for these services are provided herein.

SITE CORROSION SURVEY

Scope:

The purpose of the survey was to gather sufficient data in order to evaluate the UST facility for possible upgrade for corrosion protection with cathodic protection.

The test methods and equipment associated with the survey are discussed in detail in the attached "Corrosion Site Survey, General Requirements for Testing and Instrumentation of UST Systems". All test methods, data analysis, and design criteria are in accordance with all applicable local, state, and federal regulations. as well as the appropriate guides. standards and recommended practices of the various authoritative organizations, (i.e. EPA, NACE. NFPA. NEC, ASTM, API and PEI). All work was performed under the supervision of a NACE certified "Corrosion Specialist". All test data is tabulated on the attached data sheets.

The UST facility consists of eight (8) 12,000-gallon and one (1) 5,000-gallon underground storage tanks and associated piping.

PEI

SITE CORROSION SURVEY (continued)

Data Analysis:

- Soil Resistivity - The soil resistivity at this location ranged from 709 ohm cm to 1427 ohm cm which is indicative of a moderately corrosive environment.

- Soil pH - Measurements of the soil pH at this location ranged from 5.5 to 7.5 which is near neutral and is normal for this type of soil.

- Structure-to-Soil Potentials - The structure-to-soil potentials for the eight (8) underground storage tanks (Tank #18 - Tank #25) ranged from -436 millivolts to -571 millivolts and the structure-to-soil measurements for UST #26 ranged from -515 millivolts to -592 millivolts. The difference in structure-to-soil potentials throughout these structures is indicative of galvanic corrosion activity.

- Stray Current - Testing for the presence of stray current was conducted at this location. The results of this testing did not indicate the presence of stray current during the duration of the test (2 hours). The structure-to-soil potential measurements did not vary more than 30 millivolts during the duration of the test (2 hours). Although no stray current was recorded, there were possible sources of stray current at this facility. These sources are an impressed current cathodic protection system on a 6" gas line that passes within 20' of this UST facility, and an overhead power line running directly over the tank pad. The cathodic protection rectifier for the 6" gas line (United Gas) was not accessible so further investigation of the effect of this cathodic protection system on the UST facility could not be evaluated.

- Electrical Continuity Test - Structure-to-soil potentials vs. a fixed reference electrode indicates that tanks #18 through #25 as well as the water main that crosses the southwest corner of the UST facility were electrically continuous with each other. Tank #26 was not electrically continuous with the other tanks.

- Applied Cathodic Protection Test Current - The results of this test indicate that the UST will require more current for cathodic protection than what would normally be expected for this UST facility. The applied cathodic protection test current also verifies the findings of the electrical continuity test stated above.

Note: All field data is tabulated on "Corrosion Survey-Field Data Tables" and "Stray Current Interference Testing Chart" attached.

Conclusions:

The soil resistivity at this site is moderately corrosive. Consequently, it can be concluded that this environment will support localized galvanic corrosion. Test

SITE CORROSION SURVEY (continued)

measurements indicate sufficient variation in structure-to-soil potentials to suspect severe corrosive conditions. It is likely that most of the corrosion activity will be exhibited as localized pitting on exposed threading, at pipe joints, at coating holidays, and uniform attack on tanks with concentrations at welded seams and throughout tank bottom quadrants.

The overall effect of the neighboring cathodic protection system on the 6" gas line could not be concluded. The survey indicated that the UST facility was not bonded to this cathodic protection system so stray current (electrolysis) corrosion is a possibility and will likely be exhibited at the UST product piping where it crosses the 6" gas line. The stray current testing did not indicate the presence of stray current during the duration of the test. The cathodic protection rectifier for the 6" gas line was not accessible and further Investigation of the effect of this cathodic protection system of the UST facility was not possible.

PETROSCOPE" INTERNAL VISUAL INSPECTION

A visual inspection was made of these tanks with the use of the Petroscope" video camera utilizing the protocols established in accordance with ASTM ES 40-94.

Analysis:

The five (5) tanks surveyed were in excess of fifty (50) years old and had common characteristics throughout all of the tanks. Below is a listing of those common characteristics:

1. All of the welding appeared to be down-hand and the lacings were excellent. Some areas of undercut and gas vugs were evident but no ingress or movement was observed, probably due to flux shear.

2. Over the years of service, a light film has developed over the surface of these tanks due to the heating process. This film exhibits itself over the surface area from the "full line" to the bottom. Heavy trash encapsulation is prominent throughout these tanks which gives rise to an additional investigation being required since surface areas were covered and not visible for viewing due to the trash encapsulation.

3. The ullage area of these tanks was covered with excessive rust and tubercle formation which made it difficult to view the surface area. Further investigation will have to be made once these tanks are properly cleaned. Many of the areas exhibited red to black stains which are common to leakage problems.

PETROSCOPE™ INTERNAL VISUAL INSPECTION (continued)

4. The sludge in the lower extremities was excessive and accumulations were prominent along the baffle plates and bracings for the heating coils. This made it difficult to inspect the bottom area structurally. Further investigation will have to be made once this sludge is removed.

5. Multiple localized areas were observed throughout these tanks, and many were stained "red to black" which is suggestive of possible structural damage. Many of the localized areas exhibited the white crystalline stains common with pitting. Further investigation should be made of these areas once proper cleaning has been accomplished.

NOTE: A concise review log can be found in the attached tables with additional remarks and time intervals for viewing the video.

Conclusion:

Predicated on the general characteristics of these tanks. Tanknology does not feel that these tanks can be upgraded with cathodic protection until further investigation and suitable repairs are made.

We appreciate the opportunity to provide this service and look forward to working with you in the future. Should you have any questions or comments, please advise.

Respectfully,

Robert E. Hall, P.E.
Corrosion Engineering Manager
(NACE Corrosion Specialist #1320)

CORROSION SPECIALIST NACE ROBERT E. HALL 1320

REGISTERED PROFESSIONAL ENGINEER ROBERT HALL 343 CORR. STATE OF CALIFORNIA

REH/GWS/cll
Attachments

TANKOLOGY

CORROSION SURVEY - FIELD DATA AND TABLES

TABLE I
Sheet # 1 of 2

CLIENT: Johnson County Industrial Airport

STRUCTURE: UST FACILITY - Building #14

DATE OBTAINED: July 29, 1996

SURVEYED BY Gilbert Schutza

STRUCTURE TO SOIL POTENTIALS vs $Cu/CuSO_4$ (Millivolts)

I 1.86 Amps

NO	LOCATION		LOCAL REFERENCE ELECTRODE NATIVE	LOCAL REFERENCE ELECTRODE OFF	LOCAL REFERENCE ELECTRODE ON	LOCAL REFERENCE ELECTRODE Δ	REMOTE REFERENCE ELECTRODE NATIVE	REMOTE REFERENCE ELECTRODE OFF	REMOTE REFERENCE ELECTRODE ON	REMOTE REFERENCE ELECTRODE Δ
	TANK #18	VENT	465				820			
		4' RISER	494	501	509	15	820			
		(MANWAY) 4" RISER	551				820			
	TANK #19	VENT	470				820			
		4' RISER	498	509	510	12	820			
		(MANWAY) 4' RISER	533				820			
	TANK #20	VENT	436				820			
		4' RISER	466	492	492	6	803			
		(MANWAY) 4' RISER	532				820			
	TANK #21	VENT	465				820			
		4' RISER	495	501	525	30	820			
		(MANWAY) 4' RISER	-533				820			
	TANK #22	VENT	-509				820			
		4' RISER	-547	-568	570	23	820			
		(MANWAY) 4" RISER	-511				N/A			
	TANK 123	VENT	-571				-820			
		4' RISER	-583	-594	-598	-15	-820			
		(MANWAY) 4' RISER	-540				NIA			
	TANK 124	VENT	-476				-820			
		4' RISER	-569	-570	-571	-2	820			
		(MANWAY) 4" RISER	-548				820			

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CORROSION SURVEY - FIELD DATA AND TABLES

TABLE I
Sheet # 2 of 2

CLIENT: Johnson County Industrial Airport	STRUCTURE-TO-SOIL POTENTIALS
STRUCTURE: UST FACILITY - Building #14	vs $Cu/CuSO_4$
DATE OBTAINED: July 29, 1996	(Millivolts)
SURVEYED BY: Gilbert Schutza	I = 1.86 Amps

NO	LOCATION		LOCAL REFERENCE ELECTRODE				REMOTE REFERENCE ELECTRODE			
			NATIVE	OFF	ON	Δ	NATIVE	OFF	ON	Δ
	TANK #25	VENT	520				-820			
		4" RISER	540	-568	-579	-39	-820			
		(MANWAY) 4" RISER	530				-820			
	TANK #26	VENT	515				-939			
	(I = 0.5 amps)	4" RISER	552				-939			
		(MANWAY) 4" RISER	-592	-598	-616	-24	-939			
		(NEAR VENT) 4" FILL	-515				-939			
	4" REMOTE FILL LINE		465	-545	-946	-481	-820			
	WATER MAIN VALVE NEAR REMOTE FILL		465				-820			
	WATER MAIN VALVE FRONT BUILDING #14						-938			
	FIRE HYDRANT IN FRONT OF BUILDING #14						906			
	6" GAS LINE	STREET SIDE	1639				-1638			
		TANK SIDE	1525				-1638			
		1.5" BLEEDER LINE					-1638			
••	UNITED GAS CATHODIC PROTECTION RECTIFIER LOCATED APPROXIMATELY 110' FROM UST FACILITY.									
	THE 6" GAS LINE IS WITHIN 20 EAST OF UST FACILITY AND CROSSES THE PRODUCT PIPING TO THE BUILDING.									
••	WATER LINE, SIZE UNKNOWN CROSSES SOUTHWEST CORNER OF UST FACILITY									

TANKNOLOGY

CORROSION SURVEY - FIELD DATA AND TABLES

TABLE II
Sheet 1 of 2

CLIENT: Johnson County Industrial Airport

STRUCTURE: UST FACILITY Building #14

DATE OBTAINED: July 30, 1996

SURVEYED BY: Gilbert Schutza

SOIL / ELECTROLYTE DATA

Resistivity: (ohm cm)

pH : (Unitless)

WENNER 4 PIN METHOD

NO	LOCATION		pH	PIN SPACING			LAYER RESISTIVITY		
				0-5'	0-7.5'	0-10'	5-7.5'	7.5-10'	5-10'
1	20' NORTHWEST OF UST FACILITY			958	1041	1053	1262	[illegible]	1170
2	20' NORTHEAST OF UST FACILITY			1341	1135	1092	868	980	920
3	10' EAST OF UST FACILITY			709	761	662	894	1427	1099
1	TANK #18	NORTH END	6.25						
		SOUTH END	6.40						
2	TANK #19	NORTH END	6.40						
		SOUTH END	6.50						
3	TANK #20	NORTH END	5.50						
		SOUTH END	6.10						
4	TANK #21	NORTH END	6.60						
		SOUTH END	6.75						
5	TANK #22	NORTH END	6.20						
		SOUTH END	6.80						
6	TANK #23	NORTH END	6.65						
		SOUTH END	7.50						

CORROSION SURVEY - FIELD DATA AND TABLES

TABLE II
Sheet 2 of 2

CLIENT: Johnson County Industrial Airport

STRUCTURE: UST FACILITY Building #14

DATE OBTAINED: July 30, 1996

SURVEYED BY: Gilbert Schutza

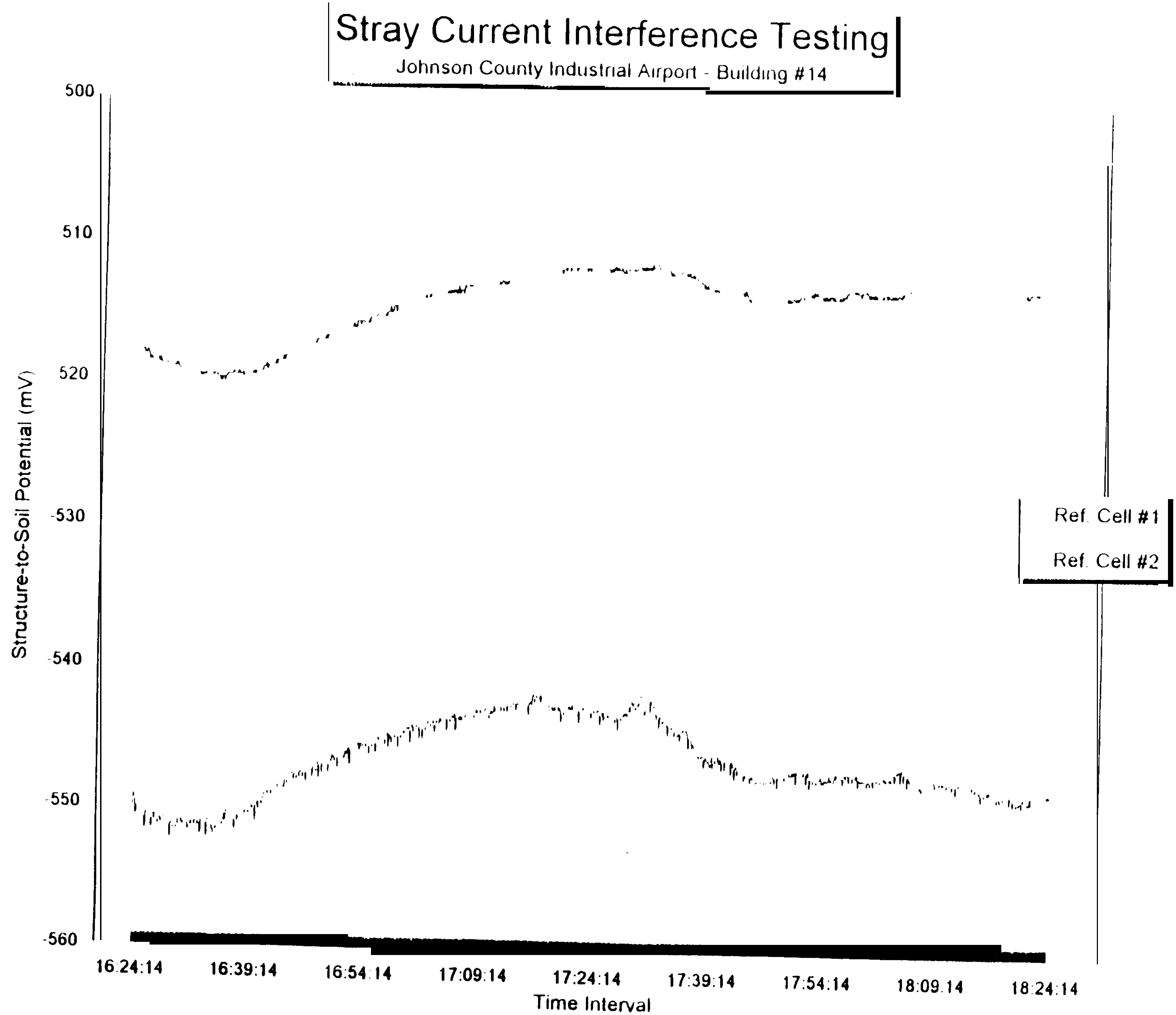
SOIL / ELECTROLYTE DATA

Resistivity: (ohm cm)

pH : (Unitless)

WENNER 4-PIN METHOD

NO	LOCATION		pH	PIN SPACING			LAYER RESISTIVITY		
				0-5'	0-7.5'	0-10'	5-7.5'	7.5-10	5-10
7	TANK #24	NORTH END	6.90						
		SOUTH END	6.80						
8	TANK #25	NORTH END	6.50						
		SOUTH END	6.50						
9	TANK #26	NORTH END	6 50						
		SOUTH END	6.00						


Stray Current Interference Testing
Johnson County Industrial Airport - Building #14
Ref. Cell #1
Ref. Cell #2
Structure-to-Soil Potential (mV)
500
510
520
-530
-540
-550
-560
Time Interval
16:24:14
16:39:14
16:54:14
17:09:14
17:24:14
17:39:14
17:54:14
18:09:14
18:24:14

PETROSCOPE™ INTERNAL VISUAL INSPECTION
Johnson County Industriai Airport - Building #14
Inspection Performed on July 29, 1996

VIDEO TAPE REVIEW			
TIME	TANK#/SIZE	CONTENTS	COMMENTS
TAPE 1 OF 2			
	#1(19) 12K	Diesel	**Further Investigation Necessary**
0:01:41			Rusted and scarred area at 5 o'clock on sideshell
0:02:20			Rusted scale in overhead
0:02:26			Heating coil system bottom of tank exhibits no corrosion. Brackets/braces not visible due to excessive sludge build-up.
0:03:23			Localized areas of corrosion exhibiting stain surrounding pinpoint rust with dark black centers. Suspect.
0:03:32			All welding appears to be downhand with good lacing. A few areas of excessive weld slag with slight undercut.
0:04:17			Excessive sludge build-up. Suspect area in bottom.
0:05:32			Flux pockets in weld with undercut areas.
0:07:34			Rust stain along weld seam at undercut suspect. Excessive weld spatter/beads not removed
0:11:19			Rusted with stain (red to black) along scarred area at 10 o'clock. Suspect.
0:15:21 to 0:16:53			Localized areas appear wet on sideshell at 2 o'clock. Areas exhibit sediment build-up and a black stain at the center. Suspect. Possible Penetration.
	#2 (23) 12K	**Diesel**	**Further Investigation Necessary**
0:51:15			Rust nodules in overhead.
0:51:50			Heavy weld slag in overhead.

VIDEO TAPE REVIEW			
TIME	TANK#/SIZE	CONTENTS	COMMENTS
0 59:47			Excessive sludge in tank bottom around area of coils/braces.
1:00:07			Scarred area with dark red/black stain and sediment build-up at 3 o'clock. Suspect
1:05:37			Possible pinholes on sideshell. Dark stain and sediment build-up at 3-5 o'clock. No ingress of fluid observed.
1:11:37			Dark scar on steel (reddish brown to black) with sediment stain in bottom of tank at 5 o'clock. Suspect.
	#3 (18) **12K**	Diesel	**Further Investigation Necessary**
1:30:23			Excessive rust in overhead at both ends.
13142			Excessive film caused by heating throughout tank on sideshell beiow fuel level line. This film has excessive trash encapsulation. Needs to be cleaned for further review.
1:35:18 to 1:37:42			Scarring from CO, inerting process evident on sideshell at mid-tank.
1:37:55 to 1:38:34			Wet area at seam weld on sideshell at 3-9 o'clock. Further investigation of this **area** is necessary.
1:45:08			Wet streaked areas with small pinhole ingress of fluid at 3 o'clock. Must be investigated further.
1:50:41			Sediment build-up and stain on **isolated area.** No ingress at this spot. **Mid-tank** 7 o'clock. 5-6 streaks. Suspect.
TAPE #2 OF 2			
	#4 (25) 12K	Diesel	Further **Investigation Necessary**

VIDEO TAPE REVIEW			
TIME	TANK#/SIZE	CONTENTS	COMMENTS
0:00:44			Heavy sludge in bottom and trash encapsulated film common to all tanks from 3-8 o'clock.
0:01:32			Heavy build-up of rust and tubercles in overhead around fill area. Suspect.
0:01:53 to 0:02:18			Rusted in overhead at south end of tank. Exhibits very large tubercle build-up.
0:08:05			Isolated area of wet streaks and sediment build-up Stain in overhead at 11 o'clock on southwest side at mid-tank. Heavy trash encapsulated in film appears to be lifting. Condensation in several spots show no ingress or movement.
0:19:20			Localized rusted area (heavy stains) mid-tank at 7 o'clock sideshell. Suspect.
0:20:31			Wet streaked area on sideshell southeast at 3 o'clock.
0:21:14			Localized wet spot with sediment stain at 5 o'clock in bottom sludge area. Observed no movement.
0:21:23			Traces lead to area of excessive salt build-up at 3-5 o'clock. Highly suspect.
0:22:45			Two (2) areas of extreme salt\sediment build-up at 9 o'clock No movement observed.
0:25:42 to 0:27:29			Localized areas of salt build-up from 3-5 o'clock and at 7 o'clock. Wet streaks but no movement or ingress observed.
0:31:14			Some pitting on the transfer fuel lines and fill line.
	#5 (24) 12K	Diesel	Further **Investigation Necessary**
0:55:01 and 0:55:28			Several localized spots appear wet with condensation beads in overhead. Highly susoec:
0:55:44			Hairline cracks in film overhead.

VIDEO TAPE REVIEW			
TIME	TANK#/SIZE	CONTENTS	COMMENTS
0:57 53			Hairline cracks in film at 9 o'clock on sideshell.
1 02.49			Film encapsulated with trash. Heavy **from** fluid level to bottom on both sides.
1:04:06			Undercut along weld seam rusted. Some stain observed. Suspect.
1.05 36			Localized areas of salt build-up on sideshell at 8 o'clock.
1:23:24			Slight pitting on fuel lines.
1.45 32			Sediment stain and salts build-up on localized area of sideshell at 3 o'clock.
1:51:24			Film exhibits hairline cracks 1/8" thick at 10 o'clock.

Armor Shield®

EPA Study

Tank Inspection Report

Gardner, Kansas City

ARMOR SHIELD, INC. • RTE. 2, BOX 106A • FALMOUTH, KY 41040, (606) 654-8265 FAX (606) 654-4746

Introduction

This report is in regards to the internal inspection of 5 tanks located at the Johnson County Industrial Airport facility in Gardner City. This inspection was performed by Armor Shield, Inc. in cooperation with Double Check (Armor Shield Kansas City) and US Inspection Services

Description of Internal Inspection Methods

The inspection consisted of sandblasting all the tanks and performing a visual inspection in combination with various destructive and nondestructive testing methods:

Destructive Mefhods:

Sandblasting

A brush blast was performed on tank numbers 18, 19, 20 and 24. Tank #25 was sandblasted to a near white metal at the request of MRI. After the sandblasting was complete, the tanks were visually scanned for corrosion holes, internal pitting, and seam splits. Internal pits were measured using a W R. Thorpe Co. Pit Gauge.

Hammer Testing

If severe corrosion in areas of the tank are identified or are suspected during the visual inspection, additional testing such as hammer or other destructive inspection techniques may be used to identify areas where severe corrosion may be taking place. Hammer testing is sometimes used before abrasive blasting as an initial inspection tool to open up rust plugged holes and to examine other areas which appear to be corroded (Section A10.3.1 and A10.3.2 of NLPA 631 and section C.2.3.J of API 653). NLPA 631 requires that areas around perforations be sounded for thin areas(Section A 10.3.3). API 1631 also requires hammer testing around perforations to remove thin metal and to obtain structurally sound edges around perforations (section 4.3.2.6 of API 1631). The hammer test was performed at the request of MRI.

Nondestructive Methods:

Non destructive test methods to determine pitting were performed pursuant 4.3.2.2 of API 1631

Non Destructive Testing - Magnetic Flux Inspection

A magnetic flus inspection method was used to determine the metal thickness of pitted areas. This method involved scanning the surface of the tank with a magnetic flux device in combination with ultrasonic prove - up to determine metal thickness of pitted areas

Alternative non - destructive rest #1:

An alternative non-destructive test method was performed at the request of MRI. The tank was subdivided into a 3' x 3' grid as described in Appendix MI of NLPA 631 and ultrasonic thickness readings were taken within each 3' x 3' quadrant. It should be noted that section MI1.2 of Appendix MI of NLPA 631 states that the procedures are inadequate for assessment of steel tanks prior to cathodic protection retrofit.

Alternative non - destructive test #2

An alternative non-destructive test method was performed at the request of MRI. An ultrasonic scan was performed on the tank. This was accomplished by manual scanning with an ultrasonic device horizontally along the length of the tank at 1" intervals. This resulted in a total of 25 scan lines along the length of the rank. Each scan line was approximately a 1/4" wide and ultrasonic thickness readings were taken every 1/8" along the scan line. MRJ had requested a 100% scan of the tank surface. It should be noted that to inspect 100% of the tank surface, a different device such as a raster ultrasonic scanning device would of been more appropriate; however, Armor Shield was not prepared to perform a 100% ultrasonic scan. While this inspection was not a 100% ultrasonic scan it was the only inspection method that could be arranged given the time frame at the site

Non Destructive Testing General Information and Comments:

Comment #1

The magnetic flus inspection method is the primary industry practice for determining metal thickness of pitted areas on existing steel structures including pipelines and above ground storage tank bottoms.

Magnetic flux inspection is commonly used for compliance with environmental regulations for the aboveground storage tank and pipeline industry. It is also the primary inspection technology used for compliance with API 653. API 653 has similar criteria to underground tanks (API 653 specifies a 100 mill minimum of steel) for cathodic protection. Essentially, the Armor Shield magnetic flux inspection method used for underground tanks is almost identical to that used for aboveground tanks and compliance with API 653.

This methodology is significantly faster than other inspection techniques and is being used successfully for inspection of aboveground tank bottoms and pipelines in the United States as well as internationally. It is primarily used in these markets because of the overall cost effectiveness and ability to meet environmental regulations and concerns. The environmental regulatory objective of these industries are most identical to the objectives of the EPA regulations for underground tanks

In summary, magnetic flux inspection is currently recognized as one of the quickest and most economical inspection methods to assess a tanks condition and to meet environmental regulations and concerns

Comment #2

Armor Shield had intended only to perform a magnetic flux inspection. If Armor Shield had been notified in advance that MRJ wanted to perform a 100% ultrasonic scan, Armor Shield would of been prepared to perform such an inspection. If in the future EPA or MRI would like to perform such an inspection, Armor Shield would be willing to do such an inspection.

Comment #3

In general, 100% ultrasonic scanning and other ultrasonic testing methods are outdated technologies and are not state of the art in the industry for this type of inspection. Magnetic flux inspection is state of the art and is the current industry accepted pratice for performing this type of inspection. Ultrasonic scanning has limitations because it is more time consuming than magnetic flux.

Comment #4

Magnetic flux inspection of aboveground tanks and pipelines rarely requires sandblasting (it should be noted that Armor Shield included sandblasting because it is required under NLPA 631 and/or API 1631). This reduces the overall inspection time verse's other inspection methods such as ultrasonic scanning since not as much cleaning is required. A tank can be magnetic flux inspected in less time than it takes to sandblast an entire tank.

Comment #5

Magnetic flux inspection will detect both internal and external pitting as well as rust plugged holes on non sandblasted surfaces. Internal pitting and rust plugged holes can be difficult to detect prior to sandblasting since rust plugged holes and most internal pits are filled with rust or debris prior to blasting. Ultrasonic scanning methods used still requires sandblasting to detect internal pitting and rust plugged type holes. In addition, ultrasonic scanning would have a difficulty in obtaining readings from internal pits or rust plugged holes filled with rust. The magnetic flux can detect rust plugged holes, external pitting, and internal pitting easily on non - sandblasted surfaces and surfaces which may not otherwise be suitable for other non-destructive inspection methods such as ultrasonic scanning

Comment #7

There were a few minor problems encountered on the site with the battery and cable system of the magnetic flus unit; however, these problems have now been resolved. It should also be noted that US Inspections has a similar magnetic flux unit that is manufactured by the same manufacturer as the one Armor Shield used on this inspection and both units are based on the exact same components (batteries, coils, etc.). US inspections has performed numerous magnetic flux inspections of aboveground storage tank bottoms with no equipment problems. Magnetic flux type devices are very reliable and actually have better reliability than other technologies such as ultrasonic scanning

Comment #8

It should be noted that additional time was spent on this site for a variety of reasons including performing multiple inspections on the same tank, performing inspections which Armor Shield was not prepared to perform but which MRI had requested, video (which required Armor Shield personnel to operate and which stopped work at times on other tanks as the request of MRI), time consuming cleaning due to the fact that the tanks once contained number 4 fuel oil, rain (which caused water to enter the tank after sandblasting and which was reblasted at the request of MRI), and other factors which are not normally encountered on a typical site

Armor Shield believes that under normal circumstances an internal inspection of a typical UST site (which usually has 3 at a location) utilizing magnetic flux would take no more than 1 day. If requested by MRI, this can be demonstrated by Armor Shield at an actual field or test location

Comment #9

There was an area in one of the tanks which was more suitable for the hammer test evaluation and to illustrate the purpose of the hammer test. The area in the tank was suspicious in that there were several holes in a small area and what appeared to be thin metal between and around the holes. This area was not hammer tested at the request of MRI.

Comment #10

Armor Shield can provide supporting information related to the above comments if requested by MRI.

Relavent Standards

Relavent Sections of referenced standards are included in appendix I

NLPA 631 - Third Edition

NLPA 631 - Fourth Edition

API 1631 - Third Edition

API 653 - First Edition

Criteria for Suitability:

IT's letter dated July 25, 1996 described the criteria for upgrade for cathodic protection. The letter stated that "The meaning of the evaluation criteria (based on baseline tests) for upgrading UST's was clarified: each (not just one) of the criteria (i.e., no corrosion holes, no separations in tank welds, no pits deeper than .5 times the required minimum wall thickness, and average wall thickness in each 3 ft by 3 ft area of at least 85% of the required minimum wall thickness) must be met for a tank to be considered upgradable. If a tank fails one or more of the criteria, it will not be considered upgradable by cathodic protection.

Evaluation of Results by Tank Basis

Actual tank data is contained in Appendix II

Tank Number 18

This tank was sandblasted and a visual inspection was then performed. The tank was found not to be suitable due to through holes

Tank Number 19

This tank was sandblasted and partial magnetic flux inspection was performed. This tank was found not to be suitable due to through holes.

Tank Number 20

This tank was sandblasted and a visual inspection and a partial magnetic flux inspection. This tank was found not to be suitable due to through holes.

Tank Number 24

This tank was sandblasted, visually inspected and an ultrasonic scan of the tank was performed by ultrasonically scanning the entire length of the tank at 1' intervals. This tank was found not to be suitable due to pitting that exceeded 50% of the metal thickness.

Tank Number 25

Test #1 - Visual and Magnetic Flux

This tank was sandblasted, visually inspected, and a magnetic flux inspection was performed on the tank on all accessible areas except for a portion of the tank where only 50% of the area was scanned. The reason only a portion of the tank surface was scanned 50% was to determine if pitting would still be detected with only 50% of the surface being scanned. This tank was found not to be suitable due to external and internal pitting that exceeded 50%.

Test #2 - Visual and 3' x 3' Grid

This tank was visually inspected and an ultrasonic test based on a 3' x 3' grid was performed. This tank was found not to be suitable by this inspection due to internal pitting that exceeded 50% of the metal thickness and a reduction of overall wall thickness in each 3' x 3' grid at the north end of the tank shell. Specifically, all ultrasonic thickness readings of the first 3' of the tank cylinder on the north end of the tank indicate thickness readings of less than 85% of the tank metal thickness (based on an original shell thickness of 260 mills). The ultrasonic readings of the north end cap also indicate thickness readings of less than 85% of the minimum metal thickness (this is based on the construction of the south end cap which had an original thickness of approximately 280 mills). It should be noted that 3' x 3' grid measurements that were less than 85% of the metal thickness were not further subdivided at the request of MRI.

General Summary of Results and Comments of Interest Concerning Evaluation

Location of Internal Corrosion

All tanks had severe internal corrosion. The most severe internal corrosion in all of the tanks was located on the bottom of the tank and was not located directly under the fill opening.

Pitting

All tanks had external pitting greater than 50% of the original wall thickness and 2 of the tanks had internal pitting which was greater than 50% of the metal thickness.

Holes

3 of the 5 tanks had holes

Visual Inspection

Both UST sites (and thus all tanks) were determined unsuitable by visual inspection. On an individual basis, 4 of the 5 tanks were found to be unsuitable by visual inspection.

Corrosion at the North End

All the tanks on the northern site appear to be experiencing corrosion to a more severe degree at the north end. All of the holes in these tanks were found on the north end. It's also interesting to note that the ultrasonic thickness readings from the 3' x 3' grid on tank #25 (which is located on the south site) indicate that all or part of the north end of the tank shell is less than 85% of the metal thickness.

Corrosion Line on Tank 25

The magnetic flux inspection of tank #25 indicates that pitting appears to be occurring primarily at the top of that tank at the 11:00 and 10:00 position. This indicates that a fluctuation of the water table may have contributed to the pitting on this tank at this position, and; therefore, may have effected the corrosion on all of the tanks at this position.

Armor Shield Tank Inspection Report
Appendix I

The following materials were included in Armor Shield's Appendix I:

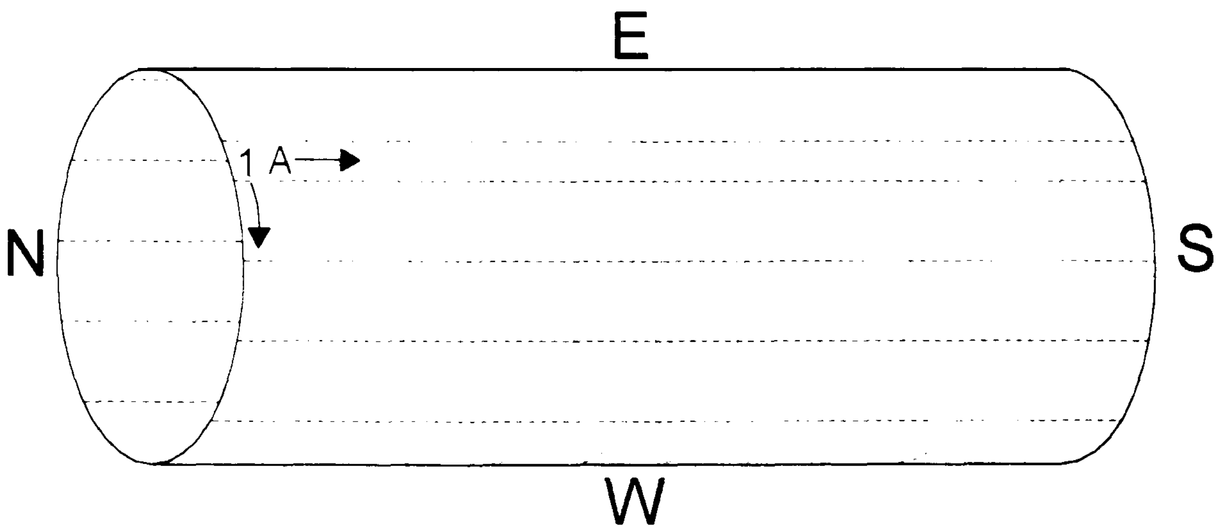
NLPA 63 1. Entry, Cleaning, Interior Inspection, Repair and Lining of USTs. National Leak Prevention Association 1991. Pages 13 and 85.

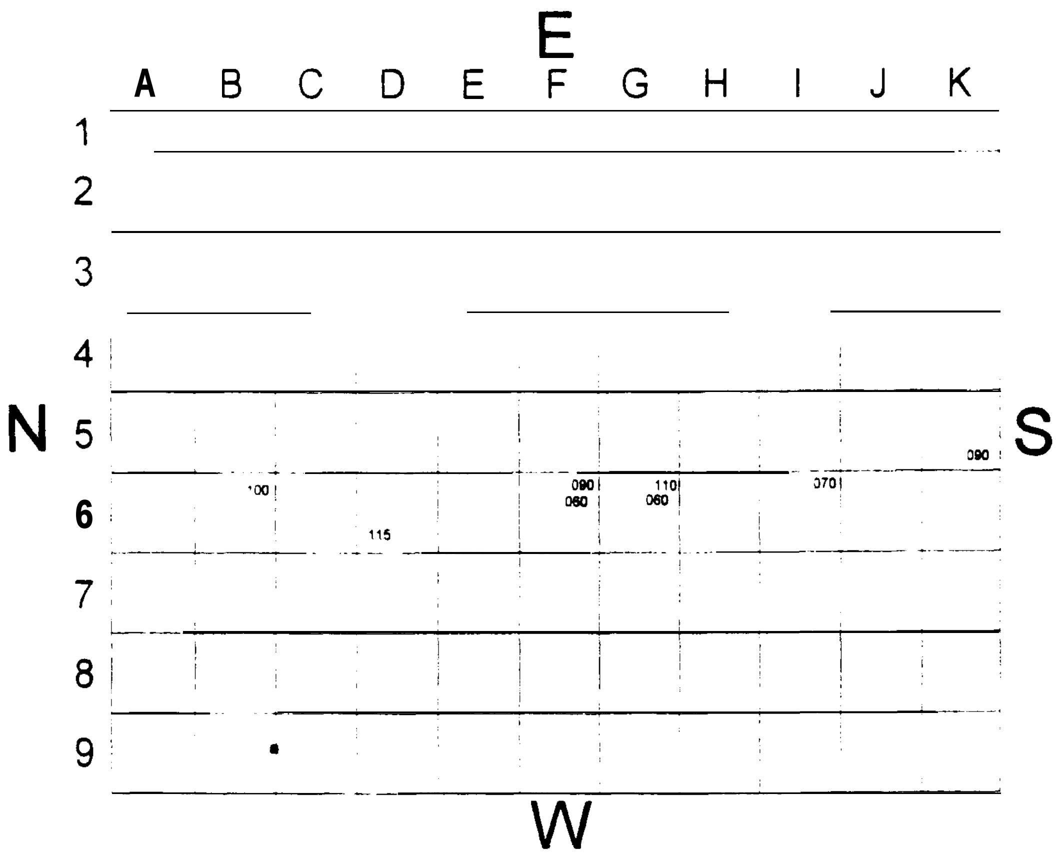
API Recommended Practice 163 1. Interior Lining of Underground Storage Tanks. Third Ed. American Petroleum Institute. April 1992. Page 7.

API Standard 653. Tank Inspection, Repair, Alteration, and Reconstruction. First Ed. January 1991 (Incorporates Supplement 1. January 1992). American Petroleum Institute. Washington DC. page C-5.

Armor Shield Tank Inspection Report
Appendix II

ARMOR SHIELD
Tank #18

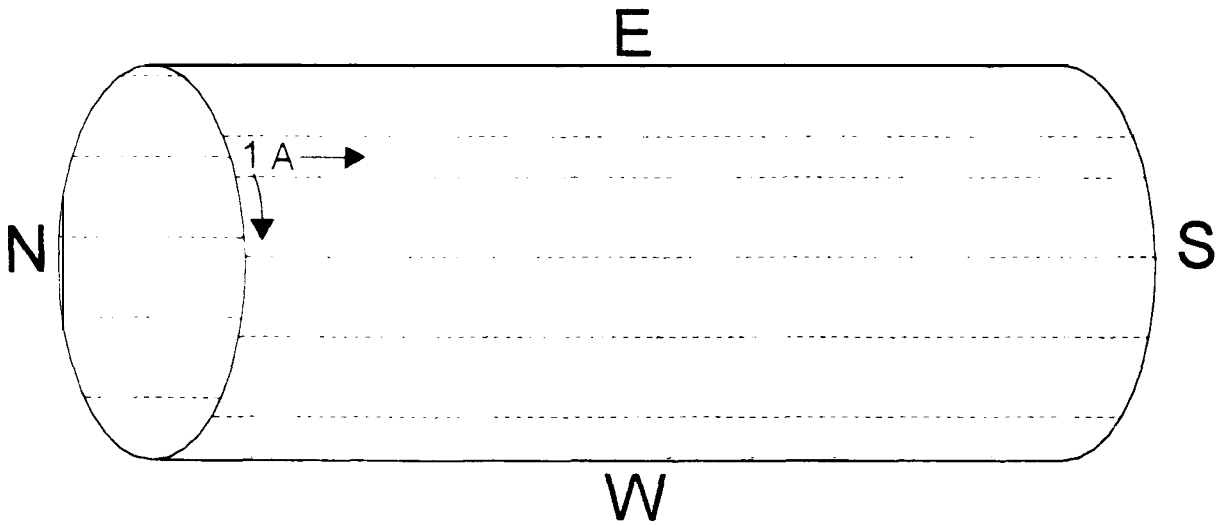


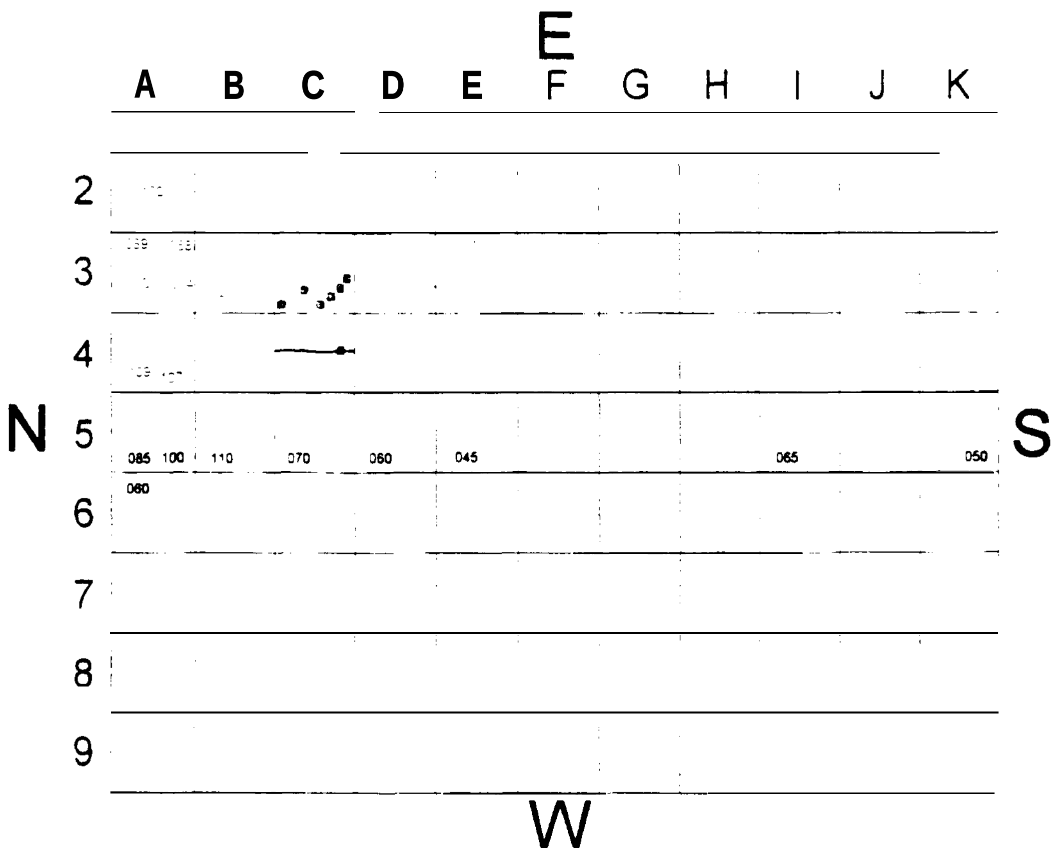


Internal Corrosion Readings

Holes

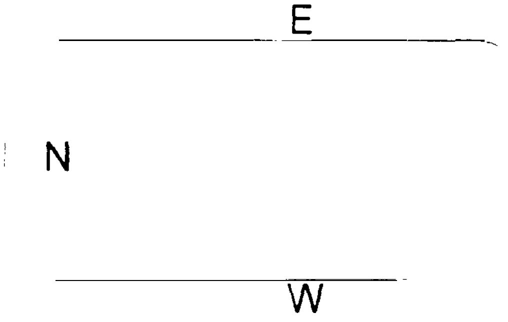
ARMOR SHIELD
Tank #19

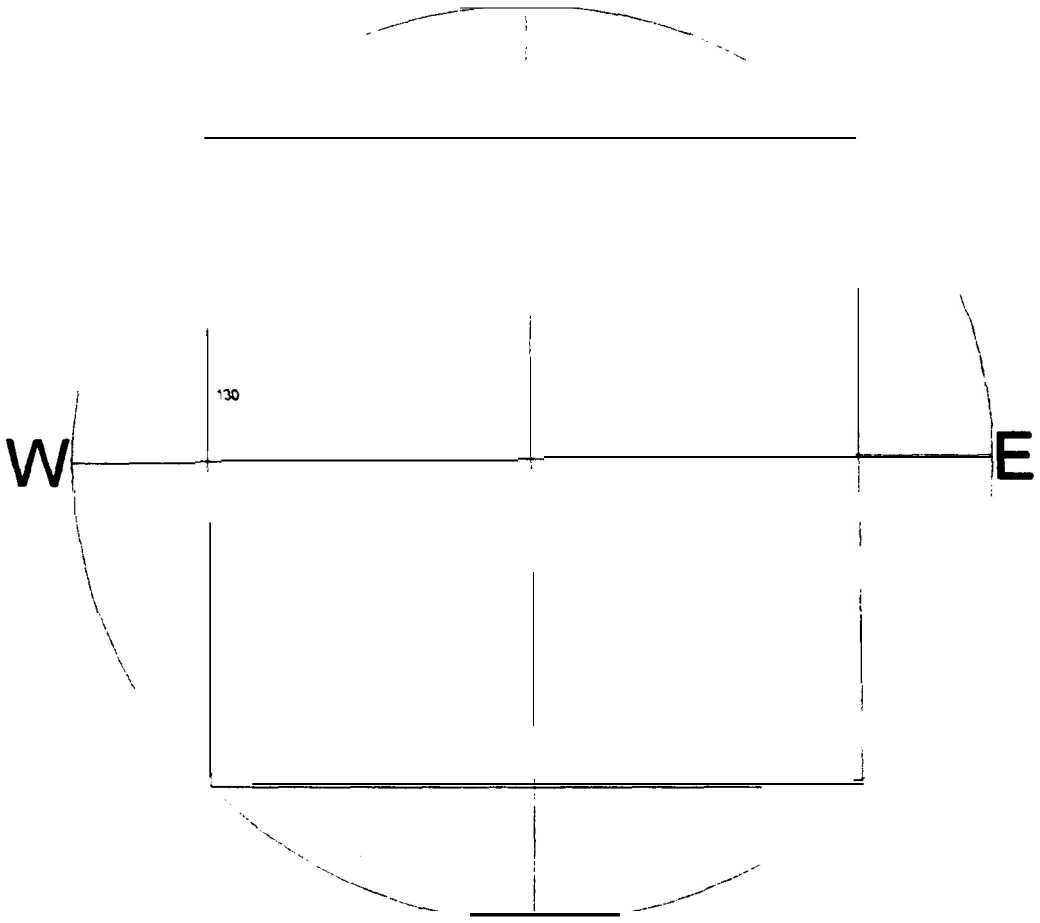




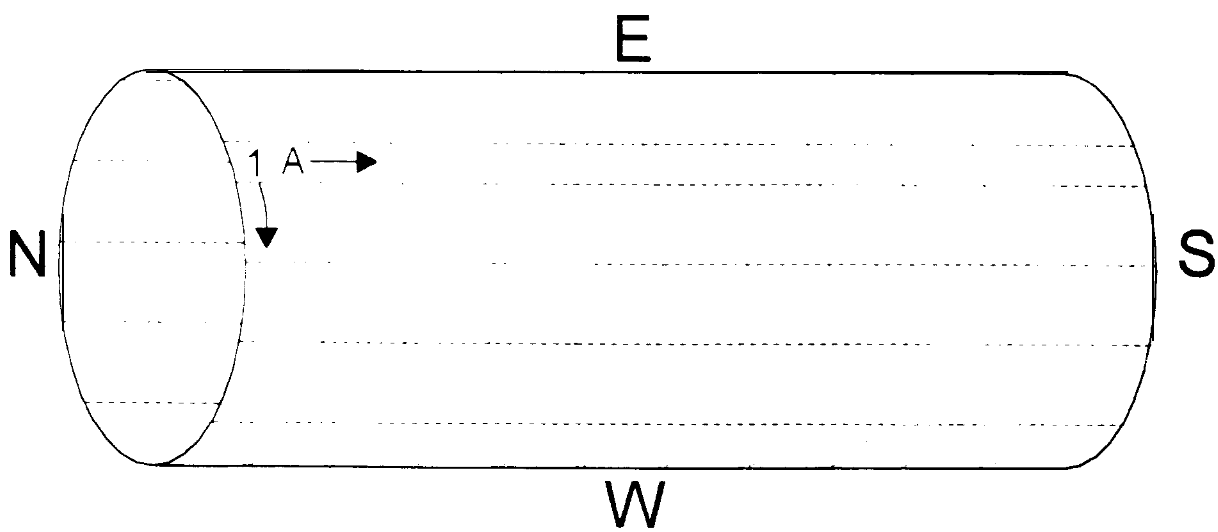
Magnetic Flux Inspection
Internal Corrosion Readings
Weld
Holes

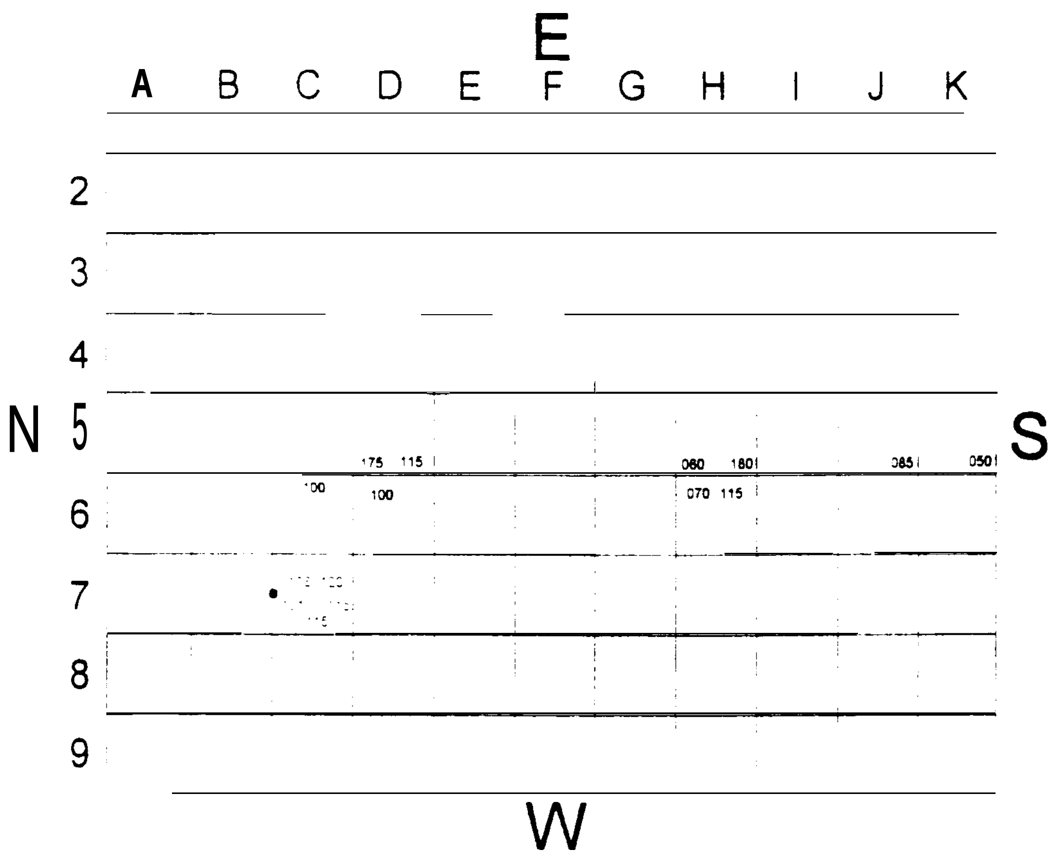
ARMOR SHIELD
Tank #19
North End of Tank





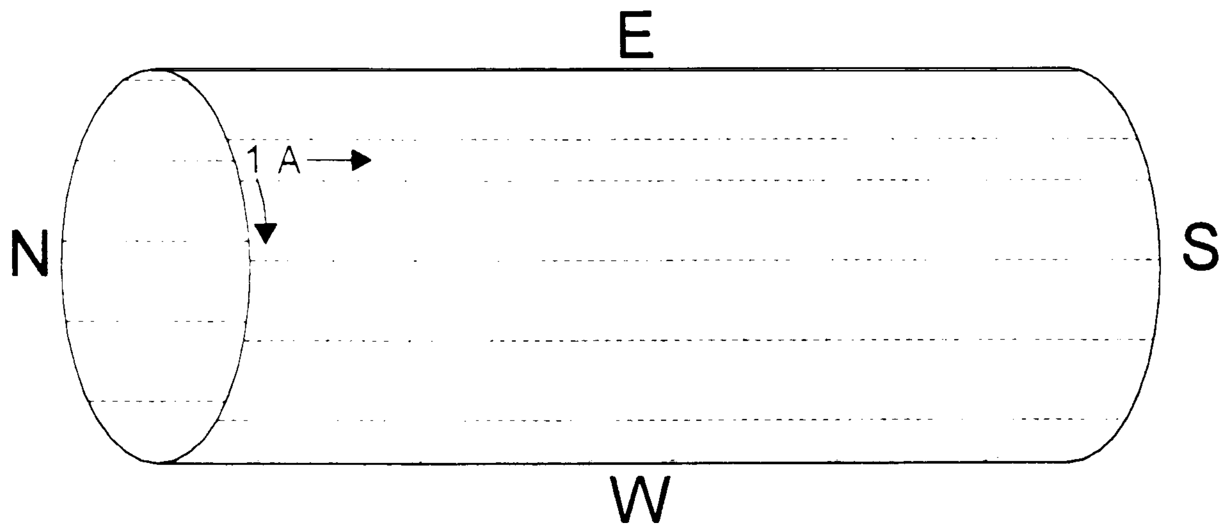
ARMOR SHIELD
Tank #20

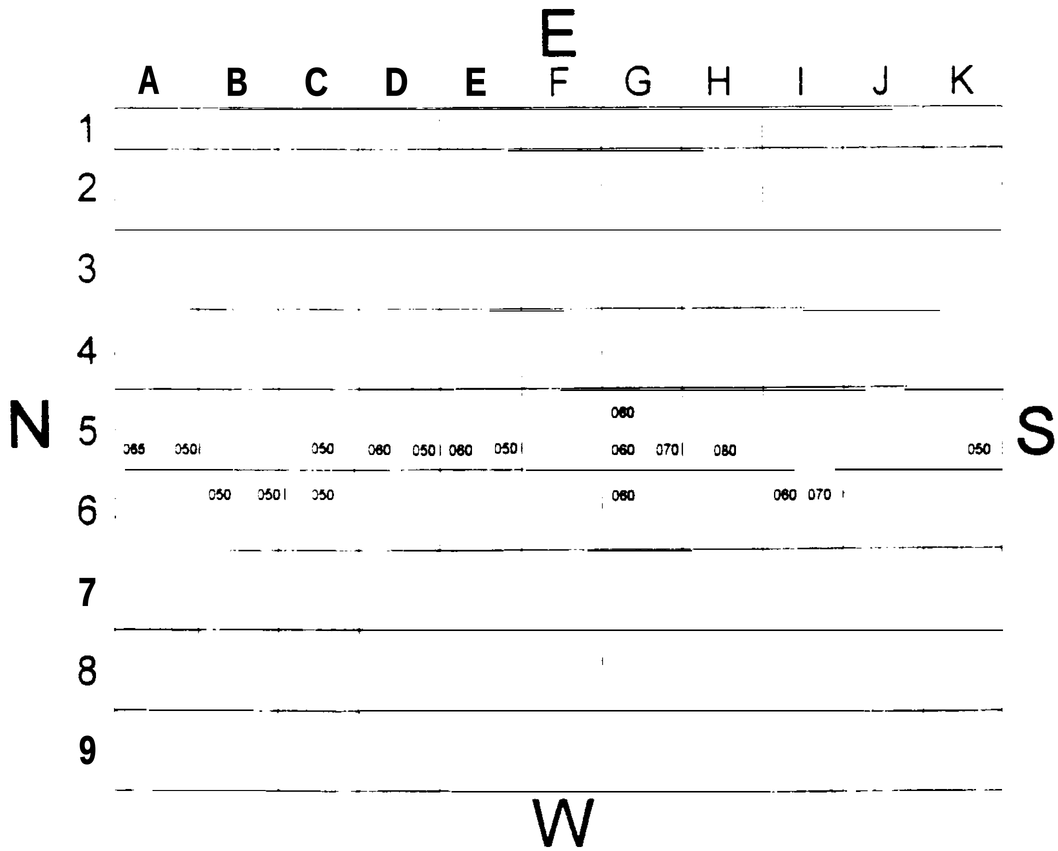




Magnetic Flux Inspection
Internal Corrosion Readings
Holes

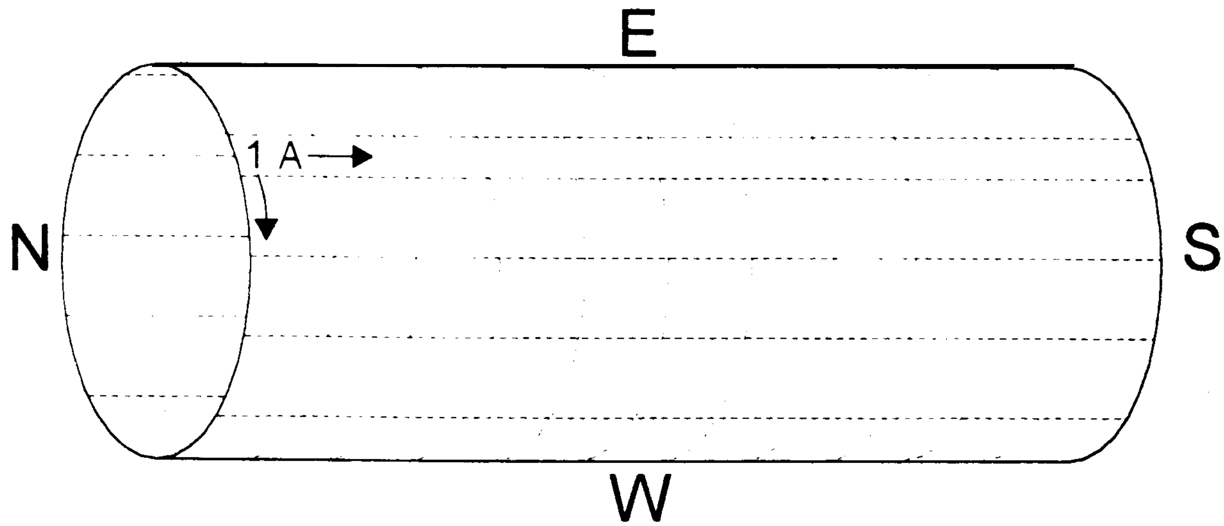
ARMOR SHIELD
Tank #24





Internal Corrosion Readings

ARMOR SHIELD
Tank #25



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N — S

	A	B	C	D	E	F	G	H	I	J	K
1	214									132	
2	217		188	149	198			130	117	168	
3	120 214			157	133	130		111	113	103	143
4	203			131							
5	140 201		.110		151 .075	110 .080					
6	214								172		
7	219										
8	.219		143	.186			.170	151	162	127	
9	211									156	

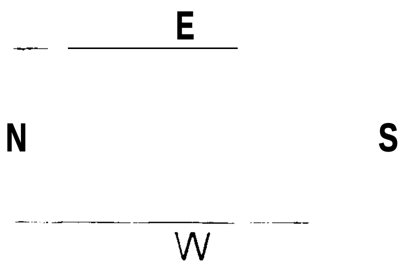
W

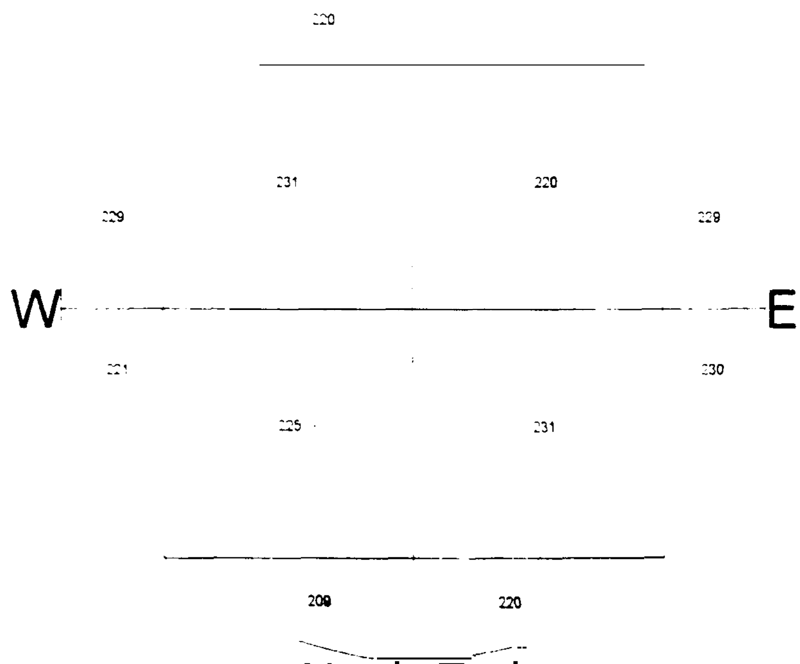
■ Magnetic Flux Inspection

■ Internal Corrosion Readings

■ 3' x 3' Grid Thickness Readings of less than 85% of the original metal thickness

ARMOR SHIELD
Tank #25
End Views





North End

■ 3' x 3' Grid Thickness Readings of less than 85% of the original metal thickness

Armor Shield

November 12, 1996

Bob Haye
IT Corporation
11499 Chester Rd.
Cincinnati, Oh 45246
(513) 782-4700

This letter is in regards to the tank tightness test results.

It should be noted that both NLPA 631 and API 1631 require tanks to be tank tightness tested after the work is complete and before the tanks are placed back into operation. While the tank tightness testing for the tanks at the test site were performed before the internal inspection, the results of the tank tightness test (whether done before or after the internal inspection) does not affect the report since all tanks were rejected during the internal inspection.

If you have any questions, please feel free to call.

Sincerely,

Derick J. Sharp
President

PEI

ARMOR SHIELD, INC. . RTE. 2, BOX 706A . FALMOUTH, KY 41040 . (606) 654-8295 FAX (606) 654-4746

Appendix C

Baseline Test Data

Tank No. 25	Tank Location: New Century Air Center, Gardner, Kansas
Date: 9/12/96	Data entered by:Mike Raile/Joe Hennon

ULTRASONIC INSPECTION FORM

Grid A1 Subgrid 5 Thick 0.246	Grid A2 Subgrid 5 Thick 0.244	Grid A3 Subgrid 5 Thick 0.244	Grid A4 Subgrid 5 Thick 0.246	Grid A5 Subgrid5 Thick 0.251
Grid A6 Subgrid 5 Thick 0.242	Grid A7 Subgrid 5 Thick 0.242	Grid A8 Subgrid 5 Thick 0.207	Grid A9 Subgrid 5 Thick 0.233	Grid A10 Subgrid 5 Thick 0.248
Grid A8 Subgrid 1 Thick .250	Grid A8 Subgrid 2 Thick 0.265	Grid A8 Subgrid 3 Thick 0.269	Grid A8 Subgrid 4 Thick 0.246	Grid A8 Subgrid 6 Thick 0.262
Grid A8 Subgrid 7 Thick 0.250	Grid A8 Subgrid 8 Thick 0.192	Grid A8 Subgrid 9 Thick 0.259	Grid H10 Subgrid 5 Thick 0.247	Grid H9 Subgrid 5 Thick 0.229
Grid H8 Subgrid 5 Thick 0.262	Grid H7 Subgrid 5 Thick 0.265	Grid H6 Subgrid 5 Thick 0.261	Grid H5 Subgrid 5 Thick 0.183	Grid H4 Subgrid 5 Thick 0.245
Grid H3 Subgrid 5 Thick 0.242	Grid H2 Subgrid 5 Thick 0.242	Grid H1 Subgrid 5 Thick 0.241	Grid H5 Subgrid 1 Thick 0.269	Grid H5 Subgrid 2 Thick 0.247
Grid H5 Subgrid 3 Thick 0.267	Grid H5 Subgrid 4 Thick 0.242	Grid H5 Subgrid 6 Thick 0.259	Grid H5 Subgrid 7 Thick 0.269	Grid H5 Subgrid 8 Thick 0.096
Grid H5 Subgrid 9 Thick 0.264	Grid H3 Subgrid 1 Thick 0.245	Grid H3 Subgrid 2 Thick 0.245	Grid H3 Subgrid 3 Thick 0.246	Grid H3 Subgrid 4 Thick 0.245
Grid H3 Subgrid 6 Thick 0.246	Grid H3 Subgrid 7 Thick NA	Grid H3 Subgrid 8 Thick NA	Grid H3 Subgrid 9 Thick NA	Grid B1 Subgrid 5 Thick 0.240
Grid B2 Subgrid 5 Thick 0.240	Grid B3 Subgrid 5 Thick 0.243	Grid B4 Subgrid 5 Thick 0.247	Grid B5 Subgrid 5 Thick 0.267	Grid B6 Subgrid5 Thick 0.243

Tank No. 25	Tank Location: New Century Air Center, Gardner, Kansas
Date: 9/12/96	Data entered by:M. Raile, J. Hennon

ULTRASONIC INSPECTION FORM

Grid B7 Subgrid 5 Thick 0.243	Grid B8 Subgrid 5 Thick 0.264	Grid B9 Subgrid 5 Thick 0.247	Grid B10 Subgrid 5 Thick 0.247	Grid C10 Subgrid 5 Thick 0.256
Grid C9 Subgrid 5 Thick 0.241	Grid C8 Subgrid 5 Thick 0.259	Grid C7 Subgrid 5 Thick 0.233	Grid C6 Subgrid 5 Thick 0.231	Grid C5 Subgrid 5 Thick 0.267
Grid C4 Subgrid 5 Thick 0.253	Grid C3 Subgrid 5 Thick 0.250	Grid C2 Subgrid 5 Thick 0.251	Grid C1 Subgrid 5 Thick 0.245	Grid D1 Subgrid 5 Thick 0.249
Grid D2 Subgrid 5 Thick 0.246	Grid D3 Subgrid 5 Thick 0.246	Grid D4 Subgrid 5 Thick 0.248	Grid D5 Subgrid 5 Thick 0.275	Grid D6 Subgrid 5 Thick 0.235
Grid D7 Subgrid 5 Thick 0.240	Grid D8 Subgrid 5 Thick 0.246	Grid D9 Subgrid 5 Thick 0.239	Grid D10 Subgrid 5 Thick 0.256	Grid G1 Subgrid 5 Thick 0.247
GriGrid G3 Subgrid 5 Thick 0.246	Grid G4 Subgrid 5 Thick 0.247	Grid G5 Subgrid 5 Thick 0.248	Subgrid 5 Thick 0.226	Grid G6 Subgrid 5 Thick 0.241
Grid G7 Subgrid 5 Thick 0.254	Grid G8 Subgrid 5 Thick 0.255	Grid G9 Subgrid 5 Thick 0.252	Grid G10 Subgrid 5 Thick 0.266	Grid F10 Subgrid 5 Thick 0.267
Grid F9 Subgrid 5 Thick 0.257	Grid F8 Subgrid 5 Thick 0.266	Grid F7 Subgrid 5 Thick 0.257	Grid F6 Subgrid 5 Thick 0.241	Grid F5 Subgrid 5 Thick 0.268
GriGrid F3 Subgrid 5 Thick 0.249	Grid F2 Subgrid 5 Thick 0.248	Grid F1 Subgrid 5 Thick 0.252	Subgrid 5 Thick 0.250	Grid E1 Subgrid 5 Thick 0.253
GriGrid E3 Subgrid 5 Thick 0.250	Grid E4 Subgrid 5 Thick 0.250	Grid E5 Subgrid 5 Thick 0.248	Subgrid 5 Thick 0.277	Grid E6 Subgrid 5 Thick 0.248

Tank No. 25
Date: 9/12/96

Tank Location: New Century Air Center, Gardner, Kansas
Data entered by:

ULTRASONIC INSPECTION FORM

GriGrid Subgrid 5 Thick 0.256	E8 Subgrid 5 Thick 0.265	Grid E9 Subgrid 5 Thick 0.251	Grid E10 Subgrid 5 Thick 0.265	Grid N Subgrid NA Thick 0.279
Grid O Subgrid NA Thick 0.272	Grid P Subgrid NA Thick 0.37%	Grid Q Subgrid NA Thick 0.266	Grid I Subgrid NA Thick 0.276	Grid J Subgrid NA Thick 0.265
Grid K Subgrid NA Thick 0.275	Grid L Subgrid NA Thick 0.264	Grid M Subgrid NA Thick 0.270	Grid Subgrid Thick	G r i d - Subgrid Thick

Tank No. 24	Tank Location: New Century Air Center, Gardner, Kansas
Date: 9/12/96	Data entered by:M. Raile, J. Hennon

WALL THICKNESS FORM

Grid H1 Subgrid 5 Thick. 0.246	Grid Endcap Subgrid NA Thick. 0.262	Grid Subgrid Thick.	Grid Subgrid Thick.	Grid Subgrid Thick.

Tank No. 18	Tank Location: New Century Air Center, Gardner, Kansas
Date: 9/12/96	Data entered by: M. Raile, J. Hennon

WALL THICKNESS FORM

Grid G1 Subgrid 5 Thick. 0.250	Grid Endcap Subgrid NA Thick. 0.279	Grid Subgrid Thick.	Grid Subgrid Thick.	Grid Subgrid Thick.

Tank No. 19	Tank Location: New Century Air Center, Gardner, Kansas
Date: 9/12/96	Data entered by: M. Raile, J. Hennon

WALL THICKNESS FORM

Grid G1	Grid Endcap	Grid	Grid	Grid
Subgrid 5	Subgrid NA	Subgrid	Subgrid	Subgrid
Thick. 0.256	Thick. 0.267	Thick.	Thick.	Thick.

Tank No. 20	Tank Location: New Century Air Center, Gardner, Kansas
Date: 9/12/96	Data entered by: M. Raile, J. Hennon

WALL THICKNESS FORM

Grid G1 Subgrid 5 Thick. 0.257	Grid Endcap Subgrid NA Thick. 0.287	Grid Subgrid Thick.	Grid Subgrid Thick.	Grid Subgrid Thick.

Tank No. 25	Tank Location: New Century Air Center, Gardner, Kansas
Date: 9/13/96	Data entered by: J. Hennon, M. Raile

PIT DEPTH FORM

Internal Pits

Note: Use three sections for the triplicate determinations of the 5 deepest pits.

Grid D10 Subgrid 9 Depth 0.075	Grid D10 Subgrid 9 Depth 0.088	Grid D10 Subgrid 9 Depth 0.061	Grid Subgrid Depth	Grid Subgrid Depth
Grid D9 Subgrid 8 Depth 0.068	Grid D9 Subgrid 8 Depth 0.065	Grid D9 Subgrid 8 Depth 0.080	Grid Subgrid Depth	Grid Subgrid Depth
Grid E10 Subgrid 3 Depth 0.109	Grid E10 Subgrid 3 Depth 0.106	Grid E10 Subgrid 3 Depth 0.095	Grid Subgrid Depth	Grid Subgrid Depth
Grid E10 Subgrid 5 Depth 0.063	Grid E10 Subgrid 5 Depth 0.071	Grid E10 Subgrid 5 Depth 0.061	Grid Subgrid Depth	Grid Subgrid Depth
Grid E1 Subgrid 3 Depth 0.105	Grid E1 Subgrid 2 Depth 0.100	Grid E1in Subgrid 3 Depth 0.100	Grid Subgrid Depth	Grid Subgrid Depth

Tank No. 25	Tank Location: New Century Air Center, Gardner, Kansas
Date: 9/13/96	Data entered by: J. Hennon, J. Flora

PIT DEPTH FORM

External Pits

Note: Use three sections for the triplicate determinations of the 5 deepest pits.

Grid B1 Subgrid 4,5 Depth 0.158	Grid B1 Subgrid 4,5 Depth 0.177	Grid B1 Subgrid 4,5 Depth 0.194	Grid Subgrid Depth	Grid Subgrid Depth
Grid B6 Subgrid 7 Depth 0.170	Grid B6 Subgrid 7 Depth 0.163	Grid B6 Subgrid 7 Depth 0.162	Grid Subgrid Depth	Grid Subgrid Depth
Grid B10 Subgrid 5 Depth 0.150	Grid B10 Subgrid 5 Depth 0.145	Grid B10 Subgrid 5 Depth 0.154	Grid Subgrid Depth	Grid Subgrid Depth
Grid C2 Subgrid 3 Depth 0.162	Grid C2 Subgrid 3 Depth 0.158	Grid C2 Subgrid 3 Depth 0.161	Grid Subgrid Depth	Grid Subgrid Depth
Grid C7 in Subgrid - Depth 0.190	Grid C7 in Subgrid 3 Depth 0.196	Grid C7 in Subgrid 3 Depth 0.189	Grid Subgrid Depth	Grid Subgrid Depth
Grid C7 out Subgrid 3 Depth 0.197	Grid C7 out Subgrid - Depth 0.200	Grid C7 out Subgrid - Depth 0.199	Grid Su Depth	Grid Subgrid Depth

Tank No. 25	Tank Location: New Century Air Center
Date: 9/10/96	Data entered by: JH & JF

TANK VISUAL INSPECTION FORM

Internal/External External Abrasive Blasted (Y/N) Yes Page 1

Grid ID A1 Percent Area Corroded 10 Subgrid of Large Dent

Hole Subgrid V. Deep Pit Subgrid 8(0.1) Deep Pit Subgrid

Many Shallow Pits? 7&8 Pattern? General Corrosion?

Comments

Grid ID A3 Percent Area Corrode 15 Subgrid of Large Dent

Hole Subgrid V. Deep Pit Subgrid Deep Pit Subgrid 8 (0.08)

Many Shallow Pits? 7,8,9 Pattern? General Corrosion?

Comments

Grid ID A3 Percent Area Corroded 20 Subgrid of Large Dent 3

Hole Subgrid V. Deep Pit Subgrid Deep Pit Subgrid 7,8 (0.095)

Many Shallow Pits? 6,7,8,9 Pattern? General Corrosion?

Comments

Grid ID Ad Percent Area Corroded 20 Subgrid of Large Dent 1,3,9

Hole Subgrid V. Deep Pit Subgrid Deep Pit Subgrid 7,8 (0.07)

Many Shallow Pits? 1,4,7 Pattern? General Corrosion?

Comments Crease, 5 through 7

Grid ID A5 Percent Area Corroded 70 Subgrid of Large Dent 2,5

Hole Subgrid V. Deep Pit Subgrid 8 (0.115) Deep Pit Subgrid 2,9

Many Shallow Pits? yes Pattern? General Corrosion? All

Comments Manway cut out at 3

Tank No. 25	Tank Location: New Century Air Center
Date: 9/10/96	Data entered by: JH & JF

TANK VISUAL INSPECTION FORM

Internal/External External Abrasive Blasted (Y/N) Yes Page 2

Grid ID A6 Percent Area Corroded 75 Subgrid of Large Dent 1,2,3,4

Hole Subgrid ______ V. Deep Pit Subgrid 8 (0.11) Deep Pit Subgrid 6,7

Many Shallow Pits? Most Pattern? ______ General Corrosion? ______

Comments Manway cut out at 1; pitted area defined by perimeter of concrete manway pit

Grid ID A7 Percent Area Corroded IF Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid 6 (0.10) Deep Pit Subgrid 4,5 (0.06)

Many Shallow Pits? 5.h.7. Pattern? ______ General Corrosion? ______

Comments Back hoe mark in 7

Grid ID A8 Percent Area Corroded 75 Subgrid of Large Dent 4

Hole Subgrid ______ V. Deep Pit Subgrid 4,5 (0.12) Deep Pit Subgrid 4,5,7,8

Many Shallow Pits? Yes Pattern? Striations and undercut General Corrosion? ______

Comments Crease in 5 & 6; striations in longitudinal direction of tank (bacterial?)

Grid ID A9 Percent Area Corroded 15 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 4,6 Pattern? Straitions General Corrosion? ______

Comments Crease, 4,5,6

Grid ID A10 Percent Area Corroded 60 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 6 (0.08)

Many Shallow Pits? All Pattern? ______ General Corrosion? ______

Comments ______

Tank No. 25	Tank Location: New Century Air Center
Date: 9/10/96	Data entered by: JH & JF

TANK VISUAL INSPECTION FORM

Internal/External External Abrasive Blasted (Y/N) Yes Page 3

Grid ID El Percent Area Corroded 5 Subgrid of Large Dent 3

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Few shallow, up to 0.04

Grid ID E2 Percent Area Corroded 5 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Few shallow, 0.03-0.04

Grid ID E3 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Clean; some pitting in circumferential weld

Grid ID Ed Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Clean

Grid ID E5 Percent Area Corroded 3 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 7,8,9 Pattern? ____ General Corrosion? ____

Comments Shallow pits parallel to longitudinal weld

Tank No. 25	Tank Location: New Century Air Center
Date: 9/10/96	Data entered by: JH & JF

TANK **VISUAL INSPECTION FORM**

Internal/External External Abrasive Blasted (Y/N) Yes Page 4

Grid ID E6 Percent Area Corroded ____ Subgrid of Large Dent 2, 7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits'? 7 Pattern? ____ General Corrosion? ____

Comments Shallow pits parallel to weld (0.04)

Grid ID E7 Percent Area Corroded 5 Subgrid of Large Dent 2, 5, 6

Hole Subgrid ____ V Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits'? P a t t e r n ' ? ____ General Corrosion? ____

Comments (0.04)

Grid ID E8 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Clean; hoe mark in 9

Grid ID E9 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Hoe mark in 7, 8

Grid ID E10 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Exfoliation in 2, 5; sharp edges exposed

Tank No. 25	Tank location: New Century Air Center
Date: 9/10/96	Data entered by: JH & JF

TANK VISUAL INSPECTION FORM

Internal/External External Abrasive Blasted (Y/N) Yes Page 5

Grid ID D1 Percent Area Corroded 5 Subgrid of Large Dent 1,2,4,8

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? Yes Pattern? ______ General Corrosion? ______

Comments 0.01-0.02 ; hoe mark in 1 , 8

Grid ID D2 Percent Area Corroded 10 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 1-4,7 Pattern? ______ General Corrosion? ______

Comments 0.04 crater 1 1/4 by 1/2

Grid ID D3 Percent Area Corroded 5 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 2,3,5,6 Pattern? ______ General Corrosion? ______

Comments 0.02

Grid ID D4 Percent Area Corroded 5 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 2,3,5 Pattern? ______ General Corrosion? 9

Comments Circular pattern of shallow pits in 2

Grid ID D5 Percent Area Corroded 2 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 6,9&l-

Many Shallow Pits? 1,3,7,8 Pattern? ______ General Corrosion? ______

Comments Several hoe marks, weld spatter & weld pit in 6

Tank No. 25	Tank Location: New Century Air Center
Date: 9/10/96	Data entered by: JH & JF

TANK VISUAL INSPECTION FORM

Internal/External External Abrasive Blasted (Y/N) Yes Page 6

Grid ID D6 Percent Area Corroded 5 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 1,2 Pattern? ______ General Corrosion? ______

Comments ______

Grid ID D7 Percent Area Corroded 5 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 1,3,4,7 Pattern? Circular in 3 General Corrosion? ______

Comments Pits in 7 associated with weld

Grid ID D8 Percent Area Corroded 5 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? Yes Pattern? Longitudinal 1 & 4 (0.04) General Corrosion? ______

Comments Discolored in 4

Grid ID D9 Percent Area Corroded 3 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 9 (0.06)

Many Shallow Pits? 3,4 Pattern? Longitudinal in 4 General Corrosion? ______

Comments Exfoliation in 2, 3

Grid ID D10 Percent Area Corroded 10 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 1,2,8,9 Pattern? ______ General Corrosion? ______

Comments Longitudinal flat shallow (0.04) in 3

Tank No. 25	Tank Location: New Century Air Center
Date: 9/11/96	Data entered by: JH & MR

TANK VISUAL INSPECTION FORM

Internal/External External Abrasive Blasted (Y/N) Yes Page 7

Grid ID B1 Percent Area Corroded 40 Subgrid of Large Dent 1,4

Hole Subgrid ______ V. Deep Pit Subgrid 1,4,5,7 Deep Pit Subgrid 1,2,4,5

Many Shallow Pits? 3 Pattern? ______ General Corrosion? ______

Comments V D pits in 1&4, and 4&5 overlapping; depths 0.1 (7), 0.15 (5), 0.16 (1,4)

Grid ID B2 Percent Area Corroded 50 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 7 (0.08)

Many Shallow Pits? 1-6,8 Pattern? ______ General Corrosion? ______

Comments Circumferential weld 3-9

Grid ID B3 Percent Area Corroded 10 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid Many in 9 Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments A V D pit in 9 still has corrosion product in bottom; others 0.14

Grid ID B4 Percent Area Corroded 15 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid 2 (0.11) Deep- Pit Subgrid 1,7

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments V D pits in 2 overlapping; V D pit 3/4 dia, (0.15) at B4-9 & B5-7

Grid ID B5 Percent Area Corroded 25 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 2,3,5,6

Many Shallow Pits? few Pattern? ______ General Corrosion? ______

Comments Hoe mark in 8, many D pits in 2,3

Tank No. 25	Tank Location: New Century Air Center
Date: 9/11/96	Data entered by: JH & MR

TANK VISUAL INSPECTION FORM

Internal/External External Abrasive Blasted (Y/N) Yes Page 8

Grid ID B6 Percent Area Corroded 25 Subgrid of Large Dent 3,5

Hole Subgrid ____ V. Deep Pit Subgrid 1,7,9 Deep Pit Subgrid All

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Circ weld 1-7; pits have longitudinal striations; pit 0.15 (9) 0.165 (7)

Grid ID B7 Percent Area Corroded 20 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid 9 (0.105) Deep Pit Subgrid 1,5,6,7

Many Shallow Pits? ____ Pattern? Circ line of pits in 1,7,8 General Corrosion? ____

Comments Hoe mark in 1,2,5; Cir weld 3-9; horiz weld 9; D pits in 7&8 have striations

Grid ID B8 Percent Area Corroded 5 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 2,3,8,9 Pattern? ____ General Corrosion? ____

Comments Horiz weld 7-9; overlapping pits in 2&3, 8&9

Grid ID B9 Percent Area Corroded 3 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 1,6,9 Pattern? ____ General Corrosion? ____

Comments Circ weld 2-8; long weld 7,8

Grid ID B10 Percent Area Corroded 25 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid 5 (0.14) Deep Pit Subgrid 9 (0.06)

Many Shallow Pits? ____ Pattern? Overlapping in 5 & in 9 General Corrosion? ____

Comments Circ weld 3-9; overlapping shallow pits in 2,3

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Grid ID C1 Percent Area Corroded 15 Subgrid of Large Dent 5,6

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? Many Pattern? ______ General Corrosion? ______

Comments Hoe mark 4,7; circ pattern of shallow pits; overlapping long. pits in 5,6

Grid ID C2 Percent Area Corroded 10 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid 1(0.125), 3(0. 15) Deep Pit Subgrid 1-3

Many Shallow Pits? 4,7 Pattern? ______ General Corrosion? ______

Comments Overlapping in 4,7; circ weld 3-9; long weld 6

Grid ID C3 Percent Area Corroded 15 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid 1 (0.14) Deep Pit Subgrid 3,6(0.08)

Many Shallow Pits? 7-h Pattern? ______ General Corrosion? ______

Comments Horiz weld 4-6; V D pits in 1 overlapping

Grid ID C4 Percent Area Corroded 10 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep.Pit Subgrid ______

Many Shallow Pits? 4,5,7,8 Pattern? ______ General Corrosion? ______

Comments Horiz weld 7-9; circ weld 3-9

Grid ID C5 Percent Area Corroded 1 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 2,4 Pattern? ______ General Corrosion? ______

Comments Hoe mark 5-8

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Grid ID C6 Percent Area Corroded 5 Subgrid of Large Dent

Hole Subgrid V. Deep Pit Subgrid Deep Pit Subgrid

Many Shallow Pits? Yes Pattern? General Corrosion?

Comments Cir weld 1-7; shallow pits 2,3,4,5,8,9

Grid ID C7 Percent Area Corroded 5 Subgrid of Large Dent

Hole Subgrid V. Deep Pit Subgrid 3(0.2) Deep Pit Subgrid 2(0.09)

Many Shallow Pits? 7 Pattern? General Corrosion?

Comments Circ weld 3-9; V D pits in 3 difficult to measure due to weld; pits overlapping

Grid ID C8 Percent Area Corroded 10 Subgrid of Large Dent

Hole Subgrid V. Deep Pit Subgrid 6,9 (0.12) Deep Pit Subgrid 6,9

Many Shallow Pits? 1,2,3,6 Pattern? General Corrosion?

Comments V D pits overlapping longitudinally

Grid ID C9 Percent Area Corroded 5 Subgrid of Large Dent

Hole Subgrid V. Deep Pit Subgrid Deep-Pit Subgrid 1,2

Many Shallow Pits? 1,2,4,6 Pattern? General Corrosion?

Comments Circ weld 2-8; corrosion in weld in 2

Grid ID C10 Percent Area Corroded 5 Subgrid of Large Dent

Hole Subgrid V. Deep Pit Subgrid Deep Pit Subgrid

Many Shallow Pits? 3-5,8,9 Pattern? General Corrosion?

Comments Pits about 0.05

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Grid ID G1 Percent Area Corroded 0 Subgrid of Large Dent 1,2,4,7

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments Broken weld at end cap in 1&4; hoe mark in 4,7

Grid ID G2 Percent Area Corroded 5 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 5,8(0.09)

Many Shallow Pits? 2,7-9 Pattern? ______ General Corrosion? ______

Comments Circ weld 3-9

Grid ID G3 Percent Area Corroded 20 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid 4(0.10) Deep Pit Subgrid 4,5

Many Shallow Pits? b-9 Pattern? ______ General Corrosion? ______

Comments Tank deflection 8,9; pits overlapping in 4,5

Grid ID G4 Percent Area Corroded 30 Subgrid of Large Dent 3,6,9

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep-Pit Subgrid 5,8(0.09)

Many Shallow Pits? 2,4,5,7,8 Pattern? ______ General Corrosion? ______

Comments Circ weld 3-9; exfoliation in 3

Grid ID G5 Percent Area Corroded 10 Subgrid of Large Dent Yes

Hole Subgrid ______ V. Deep Pit Subgrid 5(0.11) Deep Pit Subgrid 9(0.09)

Many Shallow Pits? Yes- Pattern? ______ General Corrosion? ______

Comments Hoe mark 3,6; exfoliation 2,7,9; shallow pits 2,3,5,7,8,9

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Grid ID G6 Percent Area Corroded 5 Subgrid of Large Dent One

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits'? h-9 Pattern? ____ General Corrosion? ____

Comments Circ weld 1,7 horiz weld 8,9; long striation 6,9

Grid ID G7 Percent Area Corroded 10 Subgrid of Large Dent Yea

Hole Subgrid ____ V. Deep Pit Subgrid 5(0.0135) Deep Pit Subgrid 5

Many Shallow Pits? 5.8 Pattern? ____ General Corrosion? ____

Comments Circ weld 3,9 horiz weld 7-9; V D pits overlapping with horiz striations

Grid ID G8 Percent Area Corroded 10 Subgrid of Large Dent Dented

Hole Subgrid ____ V. Deep Pit Subgrid 2,3(0.1) Deep Pit Subgrid 1-3

Many Shallow Pits? 1-3,8,9 Pattern? ____ General Corrosion? ____

Comments Horiz weld 7-9; hoe mark 3,4; V D and D pits in 1-3 aligned horiz

Grid ID G9 Percent Area Corroded 3 Subgrid of Large Dent 1,4,7

Hole Subgrid ____ V. Deep Pit Subgrid 1(0.12) Deep Pit Subgrid ____

Many Shallow Pits? 1,7-9 Pattern? ____ General Corrosion? ____

Comments Circ weld 2-8; horiz weld 7,8; V D pits overlapping horiz

Grid ID G10 Percent Area Corroded 5 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 1,4,7-9 Pattern? ____ General Corrosion? ____

Comments ____

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Grid ID H1 Percent Area Corroded 2 Subgrid of Large Dent 4,7

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? yes Pattern? 1,2,3,5,6,8,9 General Corrosion? ______

Comments Long weld 7 9; riser pipe in 7; weld patches 8,9; lifting lug broken off;

Grid ID H2 Percent Area Corroded 20 Subgrid of Large Dent 7,9

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 4-6(0.07)

Many Shallow Pits? Yes Pattern? 1,3,4,5,6,7,9 General Corrosion? ______

Comments Long weld 7-9; 4" cir weld on boundary between A2-1 & H2-7

Grid ID H3 Percent Area Corroded 40 Subgrid of Large Dent Generally

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 5(0.055)

Many Shallow Pits? Yes Pattern? 2,3,4,5,6,7,8 General Corrosion? ______

Comments Hoe marks in 5 & 8

Grid ID H4 Percent Area Corroded 10 Subgrid of Large Dent Dented

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? Yes Pattern? 1,2,3,4,5,6,7,8 General Corrosion? ______

Comments Cir weld 3-9; wall thickness bore hole in 7

Grid ID H5 Percent Area Corroded 90 Subgrid of Large Dent Generally

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid 7(0.06)

Many Shallow Pits? Gen'l Pattern? overlapping General Corrosion? ______

Comments Hoe mark 4-6; 9 in manway cutout; exfoliation in 4; H5 exposed in manway pit

H1 (con't): 1 1/2" square weld patch between Al & H1 with possible pit under patch as per Armour Shield

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Grid ID H6 Percent Area Corroded 90 Subgrid of Large Dent One large

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Yes Pattern? General General Corrosion? ____

Comments Circ weld 1-7; weld patch in 2

Grid ID H7 Percent Area Corroded 15 Subgrid of Large Dent One large

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 8(0.055)

Many Shallow Pits? 2, 5 Pattern? Extensive General Corrosion? ____

Comments Hoe mark in 6; cir weld 3-9; some small pits in 3

Grid ID H8 Percent Area Corroded 60 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 2,3(0.08)

Many Shallow Pits? I-h Pattern? ____ General Corrosion? ____

Comments Hoe mark in 4,6; pits show extensive overlapping & horiz striations

Grid ID H9 Percent Area Corroded 25 Subgrid of Large Dent 6,9

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Yes Pattern? 1-6, 7,8 General Corrosion? ____

Comments Hoe mark in 6; circ weld 2-8; hor weld 2-3; 3" riser @ H 9 & A9-3

Grid ID H10 Percent Area Corroded 40 Subgrid of Large Dent 4,7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Yes Pattern? All subgrids General Corrosion? ____

Comments Hoe mark in 4; lon weld 1-3; 4 'circ weld H10-9 & A10-3;

H10 (con't): lifting lug between H10-8 & A10-2; 2" riser between H10-9 & A10-3

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Grid ID E1 Percent Area Corroded 0 Subgrid of Large Dent 4,5,7,8

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Tear from back hoe in 7; broken weld @ end cap in 4

Grid ID E2 Percent Area Corroded 0 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Circ weld 3-9

Grid ID E3 Percent Area Corroded 5 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 4-9 Pattern? ____ General Corrosion? ____

Comments ____

Grid ID E4 Percent Area Corroded 10 Subgrid of Large Dent 9

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep-Pit Subgrid ____

Many Shallow Pits? AU.-- Pattern? ____ General Corrosion? ____

Comments Circ weld 3-9; exfoliation in 6

Grid ID E5 Percent Area Corroded 3 Subgrid of Large Dent Generally

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 3 Pattern? ____ General Corrosion? ____

Comments Exfoliation 3,5,7,8

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Grid ID F6 Percent Area Corroded 3 Subgrid of Large Dent Entire

Hole S ubgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 4 Pattern? ____ General Corrosion? ____

Comments Circ weld 2-8

Grid ID F7 Percent Area Corroded 1 Subgrid of Large Dent Entire

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 2,8 Pattern? ____ General Corrosion? ____

Comments Circ weld 3-9

Grid ID F8 Percent Area Corroded 15 Subgrid of Large Dent Entire

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 6(0.09),9

Many Shallow Pits? Yes Pattern? 3,4,6,7,9 General Corrosion? ____

Comments D pits overlapping horiz

Grid ID F9 Percent Area Corroded 5 Subgrid of Large Dent ____

Hole S ubgrid ____ V. Deep Pit Subgrid ____ Deep -Pit Subgrid ____

Many Shallow Pits? 4,7 Pattern? ____ General Corrosion? ____

Comments Circ weld 2-8; hoe mark 1,2,7

Grid ID F10 Percent Area Corroded 1 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ? Pattern? ____ General Corrosion? ____

Comments ____

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Grid ID Al Percent Area Corroded 0 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments Clean

Grid ID A3 Percent Area Corroded 15 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? Yes Pattern? ______ General Corrosion? ______

Comments All pits in 1,2,3 (ullage); circ weld

Grid ID A? Percent Area Corroded 30 Subgrid of Large Dent 3,4

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? Yes Pattern? ______ General Corrosion? ______

Comments Shallow pits in 1,2,3 (ullage) and along line bottom of 9

Grid ID Ad Percent Area Corroded 25 Subgrid of Large Dent 1,6,7

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? Yes Pattern? Horiz line in 4 General Corrosion? ______

Comments Pits in 1,2,3 (ullage) and top of 4; circ weld

Grid ID AS Percent Area Corroded 20 Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? Yes Pattern? ______ General Corrosion? ______

Comments 3 cut out for manway; shallow pits 1,2,(3)

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Grid ID A6 Percent Area Corroded 50 Subgrid of Large Dent 4,5,6

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Yes Pattern? ____ General Corrosion? ____

Comments Circ & hor welds; hoe marks 1,4 pits 1-3,5 (ullage) 1 cut out for manway

Grid ID A7 Percent Area Corroded 20 Subgrid of Large Dent 7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Yes Pattern? ____ General Corrosion? ____

Comments Circ and hor welds; shallow pits in 1 2 3 (ullage)

Grid ID A8 Percent Area Corroded 15 Subgrid of Large Dent 4-7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Yes Pattern? ____ General Corrosion? ____

Comments Shallow pits bottom of 1 2 3 (ullage)

Grid ID A9 Percent Area Corroded 10 Subgrid of Large Dent 1,4,5

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Yes Pattern? ____ General Corrosion? ____

Comments Circ and hor weld; pits bottom of 1 2 3

Grid ID A10 Percent Area Corroded 25 Subgrid of Large Dent 5

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Yes Pattern? ____ General Corrosion? ____

Comments Horz weld, shallow pits 1,2,3 (ullage)

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Grid ID B1 Percent Area Corroded 0 Subgrid of Large Dent 1,4

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Surface corrosion from UT testing in 2,4,5,6,8

Grid ID B2 Percent Area Corroded 0 Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 3-9; sur corr in 7 from UT

Grid ID B3 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Sur corr in 7,8 from UT

Grid ID B4 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Circ weld 3-9; weld lug 8,9; sur corr in 7 from UT

Grid ID B5 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Sur corr from UT in 3

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Grid ID B6 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 1-7; weld lug 7,8; surf corrosion from UT in 5&9

Grid ID B7 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits'? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 3-9; sur corr from UT in 2,4,5,6,8

Grid ID B8 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V . Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Hor weld 7-9

Grid ID B9 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep. Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 2-8; weld lugs in 1 & 2; hor weld in 7&8

Grid ID B10 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments UT corr in 4&5

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Grid ID C10 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments None

Grid ID C9 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 2-8

Grid ID C8 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments None

Grid ID C7 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 3-9; UT corr in 2

Grid ID C6 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Circ weld 2-8

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Grid ID C5 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments None

Grid ID C4 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? Pattern? ____ General Corrosion? ____

Comments Cir weld 3-9; hor weld 4&5

Grid ID C3 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Hor weld 4-6; drippage from welding rod up to 1/8", undercutting along sides in 5

Grid ID C2 Percent Area Corroded ____ Subgrid of Large Dent 4,7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep-Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 3-9

Grid ID C1 Percent Area Corroded ____ Subgrid of Large Dent 6,8,9

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments None

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Grid ID D1 Percent Area Corroded ____ Subgrid of Large Dent 1,4,5,8

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? All

Comments Evaluation is interferred with by surf corr, post sandblasting

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Grid ID D2 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 7(0.07)

Many Shallow Pits? ____ Pattern? ____ General Corrosion? 75%

Comments Cir weld 3-9; weld lugs in 9

Grid ID D3 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 7,8,9 Pattern? ____ General Corrosion? 50%

Comments Weld lug in 4 (stray from welding rod)

Grid ID D4 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 5,7-9 Pattern? ____ General Corrosion? 50%

Comments Cir weld 3-9; hor weld 3; weld lugs in 8&9

Grid ID D5 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 4,7-9 Pattern? ____ General Corrosion? 40%

Comments Hor weld 1-3; weld rod splatter in 5

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Grid ID D6 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pat tern? ______ General Corrosion? d-9

Comments Cir weld 1-7; hor weld 1,7 8; weld lugs 7&8

Grid ID D7 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? 50%

Comments Hor weld 7-9; cir weld 3-9· weld lugs in 3· short hor weld 6· weld in 5

Grid ID D8 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? 5,6,8,9 Pattern? ______ General Corrosion? 50%

Comments Hor weld 4-6

Grid ID D9 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep-Pit Subgrid 8,9(0.09)

Many Shallow Pits? 7-9 Pattern? ______ General Corrosion? 30%

Comments Cir weld 2-8; hor weld 4,5; welding lugs 7&8; weld rod in 5

Grid ID D10 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid 9(0.10) Deep Pit Subgrid 9(0.06)

Many Shallow Pits? 7,8 Pattern? ______ General Corrosion? 4-9(60%)

Comments Y D pit 3/16 dia, 10 1/4 from end cap, 8 1/2 from bottom C.L.;

D10 (con't): also a 0.125 pit 0.125 dia, 7 1/2" from end cap, 11" from C.L.; D pit 3/8 dia, 11" from E.C., 2" from C.L.

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Grid ID E10 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid 5(0.1) Deep Pit Subgrid 3(0.095)

Many Shallow Pits? ____ Pattern? ____ General Corrosion? 50%

Comments Portion of 3 blocked by suction pipe; also D pit in 4(0.08); See bottom:

Grid ID E9 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 5(0.07)

Many Shallow Pits? 5 Pattern? ____ General Corrosion? 50%

Comments Cir weld 1-7

Grid ID E8 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 5(0.06)

Many Shallow Pits? 2,5 Pattern? ____ General Corrosion? 30%

Comments None

Grid ID E7 Percent Area Corroded ____ Subgrid of Large Dent 2&3

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 32 Pattern? ____ General Corrosion? 1-6

Comments Cir weld 3-9; weld lug in 5

Grid ID E6 Percent Area Corroded ____ Subgrid of Large Dent 1,2,7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? 1-3(30%)

Comments Cir weld 1-7; hor weld in 7

El0 (con't): V D pit 1/8" wide x 1/4" long, 11" from EC, 17 1/2" from CL; 2 D pits 3/16" dia, 5 1/2" from EC, 15" from CL; also D pit in 5 (0.07)

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Grid ID E5 Percent Area Corroded ____ Subgrid of Large Dent 6

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 5(0.07)

Many Shallow Pits? 5 Pattern? ____ General Corrosion? 30%

Comments Hor weld 7-8; weld rod splatter in 5

Grid ID E4 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V Deep Pit Subgrid ____ Deep Pit Subgrid 2(0.05)

Many Shallow Pits? 1,2,4,5 Pattern? ____ General Corrosion? 50%

Comments Cir weld 3-9; hor weld in 9

Grid ID E3 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 2-4(0.08)

Many Shallow Pits? All Pattern? ____ General Corrosion? 30%

Comments ____

Grid ID E2 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 2(0.06)

Many Shallow Pits? 1,2 Pattern? ____ General Corrosion? 25%

Comments Cir weld h-9

Grid ID E1 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid 2(0.09)

Many Shallow Pits? 1-3,5 Pattern? ____ General Corrosion? 50%

Comments D pits overlapping

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Grid ID E1 Percent Area Corroded ______ Subgrid of Large Dent 4,7,8

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? 5%

Comments Dent & tear in 7

Grid ID E2 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments Cir weld 3-9

Grid ID E3 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments None

Grid ID E4 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments Cir weld 3-9

Grid ID E5 Percent Area Corroded ______ Subgrid of Large Dent 6,9

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments None

Tank No. 25	Tank Location: New Century Air Center
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Grid ID E6 Percent Area Corroded ____ Subgrid of Large Dent Yes

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Major dent; cir weld 1-7; weld lug 7&8

Grid ID E7 Percent Area Corroded ____ Subgrid of Large Dent 7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments None

Grid ID E8 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments None

Grid ID E9 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 2-8

Grid ID E10 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments None

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Grid ID G10 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments None

Grid ID G9 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 2-8; hor weld in 7

Grid ID G8 Percent Area Corroded ____ Subgrid of Large Dent 4&7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Hor weld 7-9

Grid ID G7 Percent Area Corroded ____ Subgrid of Large Dent General

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? ____ Pattern? ____ General Corrosion? ____

Comments Cir weld 3-9; hor weld 9; UT corr in 5

Grid ID G6 Percent Area Corroded ____ Subgrid of Large Dent Heavy

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Marty Shallow Pits? 2 Pattern? ____ General Corrosion? ____

Comments Cir weld 1-7, UT corr in 6; pits in poor weld bead

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Grid ID G5   Percent Area Corroded ____   Subgrid of Large Dent Generally
Hole Subgrid ____   V. Deep Pit Subgrid ____   Deep Pit Subgrid ____
Many Shallow Pits? 1   Pattern'? ____   General Corrosion? ____
Comments ____

Grid ID G4   Percent Area Corroded 1   Subgrid of Large Dent 6&9
Hole Subgrid ____   V. Deep Pit Subgrid ____   Deep Pit Subgrid ____
Many Shallow Pits? 3   Pattern? ____   General Corrosion? ____
Comments Pits in poor weld; UT corr in 5

Grid ID G3   Percent Area Corroded ____   Subgrid of Large Dent ____
Hole Subgrid ____   V. Deep Pit Subgrid ____   Deep Pit Subgrid ____
Many Shallow Pits? ____   Pattern? ____   General Corrosion? ____
Comments UT corr in 4&5

Grid ID G2   Percent Area Corroded ____   Subgrid of Large Dent ____
Hole Subgrid ____   V. Deep Pit Subgrid ____   Deep Pit Subgrid ____
Many Shallow Pits? ____   Pattern? ____   General Corrosion? ____
Comments UT corr in 4,5,6,7; cir weld 3-9

Grid ID G1   Percent Area Corroded ____   Subgrid of Large Dent 1,2,4,7
Hole Subgrid ____   V. Deep Pit Subgrid ____   Deep Pit Subgrid ____
Many Shallow Pits? ____   Pattern? ____   General Corrosion? ____
Comments UT corr in 3,6,9

Tank No. 25	Tank Location: New Century Air Center
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Grid ID H1 Percent Area Corroded ____ Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 8,9 Pattern? ____ General Corrosion? ____

Comments Hoe mark in 4; hor weld 7-9; UT corr H9; pits in ullage area

Grid ID H2 Percent Area Corroded 15(ullage) Subgrid of Large Dent ____

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 7-9 Pattern? ____ General Corrosion? ____

Comments Hor weld 4-6; cir weld patch 7&8; weld burn pit (0.1) in 9

Grid ID H3 Percent Area Corroded 25 Subgrid of Large Dent 7-Q

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 4,5,7-9 Pattern? longitudinal General Corrosion? ____

Comments Pits in 7-9 in ullage

Grid ID H4 Percent Area Corroded < 1 Subgrid of Large Dent 7

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep -Pit Subgrid ____

Many Shallow Pits? 5 Pattern? ____ General Corrosion? ____

Comments Cir weld 3-9; bore hole in 8

Grid ID H5 Percent Area Corroded 20 Subgrid of Large Dent 8,9

Hole Subgrid ____ V. Deep Pit Subgrid ____ Deep Pit Subgrid ____

Many Shallow Pits? 5,7-9 Pattern? ____ General Corrosion? ____

Comments Manway cutout in 9; pits in ullage

Tank No. 25	Tank Location: New Century Air Center
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Grid ID H6 Percent Area Corroded 30(ullage) Subgrid of Large Dent Largely

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? All Pattern? ______ General Corrosion? ______

Comments ______

Grid ID H7 Percent Area Corroded 30 Subgrid of Large Dent 6

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? All Pattern? ______ General Corrosion? ______

Comments Part of corrosion is in ullage area cir weld 3-9

Grid ID H8 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments None

Grid ID H9 Percent Area Corroded ______ Subgrid of Large Dent ______

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments Cir weld 2-8; hor weld 2-3; riser hole in 9; ullage corrosion

Grid ID H10 Percent Area Corroded ______ Subgrid of Large Dent 7

Hole Subgrid ______ V. Deep Pit Subgrid ______ Deep Pit Subgrid ______

Many Shallow Pits? ______ Pattern? ______ General Corrosion? ______

Comments 2" riser in 8; 3" rir weld in 9